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THE AMERICAN EPHEMERIS AND NAUTICAL ALMANAC

FOR THE YEAR 1967

WASHINGTON

Issued by the
Nautical Almanac Office
United States
Naval Observatory
by direction of the
Secretary of the Navy
and under the
authority of Congress

LONDON

Issued by
Her Majesty's
Nautical Almanac Office
by order of the
Secretary of State
for Defence
under the title
The Astronomical Ephemeris



U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON : 1965

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THE AMERICAN EPHEMERIS AND NAUTICAL ALMANAC

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Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

THE ASTRONOMICAL EPHEMERIS

Published by
Her Majesty's Stationery Office
To be purchased from
York House, Kingsway, London W.C. 2

PREFACE

With the editions for 1960, *The American Ephemeris and Nautical Almanac* issued by the Nautical Almanac Office, United States Naval Observatory, and *The Astronomical Ephemeris* issued by H. M. Nautical Almanac Office, Royal Greenwich Observatory, were unified. With the exception of the introductory pages i, ii and vi onwards, the two publications are identical; they are printed separately in the two countries, from reproducible material prepared partly in the United States of America and partly in the United Kingdom.

The title *The Astronomical Ephemeris* replaced, without loss of continuity of content, the previous title of *The Nautical Almanac and Astronomical Ephemeris* (usually abbreviated to *The Nautical Almanac*), which was introduced by Nevil Maskelyne for the original British edition of 1767; the title *The Nautical Almanac* is now used, in both the United Kingdom and the United States, for the unified edition of the Almanacs for surface navigation previously entitled *The Abridged Nautical Almanac* and *The American Nautical Almanac* respectively.

The unification did not require any substantial changes in either publication; but a number of revisions have been made to increase the precision and improve the usefulness. The contents are fully described in the *Explanation* at the end of the volume. The principal changes from the immediately preceding volumes are for the purpose of conforming to the recommendations of the Paris Conference on Astronomical Constants in 1950 and to the resolutions of the International Astronomical Union at the Zürich Assembly in 1948, the Rome Assembly in 1952, and the Dublin Assembly in 1955. These changes are described in the *Preface* to the volume for 1960. A few small changes have been introduced since 1960, but none have been made since the edition for 1966.

Although no data are now included in respect of occultations of stars by the Moon, the occultation programme of H. M. Nautical Almanac Office continues unchanged. Arrangements for the publication of predictions have been made as follows: for stations in the United States and Canada in *Sky and Telescope*; and for other Commonwealth stations in *The Handbook of the British Astronomical Association*. Machine copies of predictions for any of the stations for which predictions are made may be obtained from H. M. Nautical Almanac Office, on request.

The apparent places of the 1535 stars in the FK4 are available in *Apparent Places of Fundamental Stars*, published annually under the auspices of the International Astronomical Union, by the Astronomisches Rechen-Institut in Heidelberg. The apparent places of the 1483 stars with declinations in the range -81° to $+81^{\circ}$ are tabulated continuously at intervals of ten upper transits at Greenwich; those of the 52 circumpolar stars, including *Polaris*, are given for every upper transit at Greenwich. Each volume also contains, for purposes of record, the Besselian Day Numbers at 12^h Greenwich sidereal time, without short-period terms, with which the apparent places of the 10-day stars are calculated. A separate list of mean places for the equinox of 1965.0 was published with the edition for 1965.

The star ephemerides that are needed by surveyors, including the tables relating to *Polaris*, are available in *The Ephemeris* prepared by the Nautical Almanac Office,

United States Naval Observatory and published by the U.S. Bureau of Land Management, and in *The Star Almanac for Land Surveyors* prepared by H. M. Nautical Almanac Office, Royal Greenwich Observatory and published by H. M. Stationery Office.

An *Explanatory Supplement* to the edition of this volume for 1960 (H. M. Stationery Office, London, 1961, reprinted 1962, price 42s.) contains detailed explanations of the data, together with a derivation and numerical illustrations, as well as useful permanent tables that are now omitted.

By international agreement, the basic calculations for this volume, and for other astronomical ephemerides such as *Apparent Places of Fundamental Stars*, and *Ephemerides of Minor Planets*, are shared between the ephemeris offices of a number of countries. Contributions, in addition to those listed below, are made by the Astronomisches Rechen-Institut in Heidelberg, the Institute for Theoretical Astronomy in Leningrad, and the offices of the *Connaissance des Temps* in Paris and the *Efemerides Astronómicas* in San Fernando.

The ephemeris of Universal and Sidereal Times, the ephemerides of the Sun, Moon, Mercury, Venus, Mars, Jupiter, Saturn, Uranus, and Neptune, the geocentric ephemerides of Ceres, Pallas, Juno, Vesta, and Pluto, the nutation in longitude and obliquity, the Day Numbers, and the Phenomena, are prepared in H. M. Nautical Almanac Office.

The conjunctions and phenomena of Satellites I–IV of Jupiter and the diagrams of the configurations are received from the office of the *Connaissance des Temps*. The data for forming Table II are received from the Astronomisches Rechen-Institut.

The remaining data in the volume are prepared in the Nautical Almanac Office, United States Naval Observatory, namely: mean places of stars; eclipses of the Sun and Moon; ephemerides for physical observations of the Sun, Moon, and planets; ephemerides of the satellites of Mars, Saturn, Uranus, and Neptune, and of Satellites V, VI, and VII of Jupiter, and of the rings of Saturn; local mean times of moonrise and moonset; Tables III, IV, and VI.

This volume was prepared jointly by H. M. Nautical Almanac Office, Royal Greenwich Observatory, under the immediate supervision of D. H. Sadler, and by the Nautical Almanac Office, United States Naval Observatory, under the immediate supervision of Raynor L. Duncombe and Ralph F. Haupt.

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December, 1964

The British edition of this publication is the two-hundredth anniversary edition of the ephemeris first published for the year 1767 under the title *The Nautical Almanac and Astronomical Ephemeris*. Although the logical successor to that primarily nautical ephemeris is *The Nautical Almanac*, *The Astronomical Ephemeris* is also in direct line of descent both in regard to content and title. To mark this occasion there is included, in the British Edition, a short account of the contents of the first edition and of its subsequent development.

A similar account is given in the British Edition of *The Nautical Almanac* for 1967; and a separate publication "A Modern View of Lunar Distances" contains calculated lunar distances for a series of dates in February 1967 together with a comprehensive illustration of their use. A copy will be sent on receipt of a request addressed to the Superintendent, U.S. Naval Observatory, Washington, D.C., 20390.

CONTENTS

v

	PAGE
Table of time-difference ΔT . Corrections	vii
Chronological Cycles and Eras; Religious Calendars	1
Calendar	2
PHENOMENA: Planetary Configurations and Magnitudes; Occultations; Diary	4
UNIVERSAL AND SIDEREAL TIMES	10
 SUN	
Ephemeris for 0^h . Precession and Nutation in Longitude; Obliquity	18
Rectangular Coordinates for Equinoxes 1967.0 and 1950.0	34, 42
Mean Orbit; Mean Longitude and Anomaly. Precessional Constants	50
 MOON	
Mean Orbit; Mean Longitude and Elongation. Mean Equator	51
Ephemeris for 0^h and 12^h	52
Right Ascension and Declination for each hour	68
Phases. Perigee and Apogee	159
 MERCURY, VENUS, MARS, JUPITER, SATURN, URANUS, NEPTUNE, PLUTO	
Heliocentric Ephemerides	160
Orbital Elements	176
Geocentric Ephemerides	178
MINOR PLANETS: Ephemerides of Ceres, Pallas, Juno, Vesta	236
 STARS	
Besselian and Independent Day Numbers for 0^h Ephemeris Time	258
Besselian Day Numbers for 0^h Sidereal Time	274
Second-order Day Numbers	278
Mean Places of 1078 Stars	282
ECLIPSES OF THE SUN AND MOON	293
 EPHEMERIDES FOR PHYSICAL OBSERVATIONS	
Sun page 300 Mars	316
Moon „ 306 Jupiter	324
Illuminated disks of Mercury and Venus „ 314 Saturn	330
 SATELLITES	
Mars page 332 Saturn (Rings) page 364 Uranus	380
Jupiter „ 336 Saturn „ 366 Neptune	383
 RISINGS, SETTINGS AND MISCELLANEOUS TABLES	
Sunrise and Sunset; Twilight	384
Moonrise and Moonset	392
Observatories	424
Table I—Julian Day Number	445
II—Pole Star Table, 1967	448
III—Reduction of mean places of stars to 1967.0	452
IV—Approximate reduction to true equinox from 1950.0	453
V—Differential Aberration	454
VI—Differential Precession and Nutation, 1967	456
VII—Factors for computing geocentric coordinates	457
VIII, IX—Conversion of mean Sidereal Time to and from Mean Solar Time	458, 461
X—Conversion of hours, minutes and seconds to decimals of a day	464
XI, XII—Conversion of Time to Arc, and Arc to Time	466, 467
XIII–XVII—Interpolation Tables	468
EXPLANATION	474
INDEX	513

The calculations for the principal ephemerides prepared in the Nautical Almanac Office, United States Naval Observatory, were made by the following members of the staff and their assistants: eclipses of the Sun and the Moon, SIMONE DARO GOSSNER; ephemerides for physical observations of the Sun, Moon, and planets, and ephemerides of the satellites of Mars, Saturn, Uranus, and Neptune, satellites VI and VII of Jupiter, and the rings of Saturn, CHARLOTTE KRAMPE; local mean time of moonrise and moonset, RALPH F. HAUPT and ARMSTRONG THOMAS. The editing and proofreading of these data are performed under the supervision of BERENICE L. MORRISON.

ΔT

REDUCTION FROM UNIVERSAL TIME TO EPHEMERIS TIME

Add to Universal Time

	s	d		s	d		s	d
1901.5	- 2.54	-.000029	1926.5	+22.72	+.000263	1951.5	+29.66	+.000343
1902.5	- 1.13	-.000013	1927.5	22.82	.000264	1952.5	30.29	.000351
1903.5	+ 0.35	+.000004	1928.5	22.92	.000265	1953.5	30.96	.000358
1904.5	1.80	.000021	1929.5	23.05	.000267	1954.5	31.09	.000360
1905.5	3.26	.000038	1930.5	23.18	.000268	1955.5	31.59	.000366
1906.5	+ 4.69	+.000054	1931.5	+23.34	+.000270	1956.5	+32.06	+.000371
1907.5	6.11	.000071	1932.5	23.50	.000272	1957.5	31.82	.000368
1908.5	7.51	.000087	1933.5	23.60	.000273	1958.5	32.69	.000378
1909.5	8.90	.000103	1934.5	23.64	.000274	1959.5	33.05	.000383
1910.5	10.28	.000119	1935.5	23.63	.000273	1960.5	33.16	.000384
1911.5	+11.64	+.000135	1936.5	+23.58	+.000273	1961.5	+33.59	+.000389
1912.5	12.95	.000150	1937.5	23.63	.000273	1962.5	34.08	.000394
1913.5	14.18	.000164	1938.5	23.76	.000275	1963.5	34.2	.00040
1914.5	15.31	.000177	1939.5	23.99	.000278	1964.5	35	. . .
1915.5	16.39	.000190	1940.5	24.30	.000281	1965.5	35	. . .
1916.5	+17.37	+.000201	1941.5	+24.71	+.000286	1966.5	+36	. . .
1917.5	18.27	.000211	1942.5	25.15	.000291	1967.5	36	. . .
1918.5	19.08	.000221	1943.5	25.61	.000296	1968.5		
1919.5	19.83	.000230	1944.5	26.08	.000302	1969.5		
1920.5	20.48	.000237	1945.5	26.57	.000308	1970.5		
1921.5	+21.06	+.000244	1946.5	+27.08	+.000313	1971.5		
1922.5	21.56	.000250	1947.5	27.61	.000320	1972.5		
1923.5	21.97	.000254	1948.5	28.15	.000326	1973.5		
1924.5	22.29	.000258	1949.5	28.94	.000335	1974.5		
1925.5	+22.55	+.000261	1950.5	+29.42	+.000341	1975.5		

The values given to whole seconds are extrapolated; those given to 0.1 are provisional values based on incomplete observational data. The values given to 0.01 are based on more extensive data; small corrections are sometimes applied when further data become available, but in general they may be considered practically final.

The values previous to 1949.5 are those of BROUWER, *Astronomical Journal*, 57, 133, 1952; his table of ΔT extends over most of the 19th century.

CIVIL CALENDAR

New Year's Day	Sun.	Jan. 1	Labor Day	Mon.	Sept. 4
Lincoln's Birthday	Sun.	Feb. 12	Columbus Day	Thu.	Oct. 12
Washington's Birthday	Wed.	Feb. 22	Election Day	Tue.	Nov. 7
Memorial Day	Tue.	May 30	Veterans Day	Sat.	Nov. 11
Independence Day	Tue.	July 4	Thanksgiving Day	Thu.	Nov. 23

ADDITIONS

The American Ephemeris

Values of the orbital eccentricity of Rhea were omitted from 1961–1965

1961	$e=0.00115$	Apr. 1–May 5	1962	$e=0.00111$	Apr. 6
	$=0.00114$	May 6–July 30		$=0.00110$	Apr. 7–June 25
	$=0.00113$	July 31–Oct. 23		$=0.00109$	June 26–Sept. 12
	$=0.00112$	Oct. 24–Nov. 17		$=0.00108$	Sept. 13–Nov. 22
1963	$e=0.00106$	Apr. 21–May 1	1964	$e=0.00101$	May 5–May 8
	$=0.00105$	May 2–July 15		$=0.00100$	May 9–July 20
	$=0.00104$	July 16–Sept. 28		$=0.00099$	July 21–Oct. 2
	$=0.00103$	Sept. 29–Dec. 7		$=0.00098$	Oct. 3–Dec. 14
				$=0.00097$	Dec. 15–Dec. 21
		1965	$e=0.00096$	May 10	
			$=0.00095$	May 11–July 23	
			$=0.00094$	July 24–Oct. 5	
			$=0.00093$	Oct. 6–Dec. 19	
			$=0.00092$	Dec. 20–Dec. 26	

CORRECTIONS

The American Ephemeris, 1963, 1964, 1965, 1966

page 499 in 1963, page 500 in 1964

page 502 in 1965, page 490 in 1966

In the equation for *magnitude of greatest partial eclipse*

for 0.5459 read 0.5464

and in the equation for *magnitude of the central phase*

for 0.5459 read 0.5464

The American Ephemeris, 1965

Page 378 Titan, e , multiply all values by 0.1

Explanatory Supplement to the Astronomical Ephemeris and the American Ephemeris and Nautical Almanac (First Edition)

- 18 Volume XVI. For 1959 read 1958
- 37 For $\omega_0 = \omega - b \sin (\Omega + c') \operatorname{cosec}$ read $\omega_0 = \omega - b \sin (\Omega + c') \operatorname{cosec} i$
- 38 For $c = 180^\circ - \Pi_m - \frac{1}{2}a$ read $c = 180^\circ - \Pi_m + \frac{1}{2}a$
 For $c' = 180^\circ - \Pi_m + \frac{1}{2}a$ read $c' = 180^\circ - \Pi_m - \frac{1}{2}a$
- 95 Line 22. For B.2. read B.1.
- 98 Mean anomaly—the second expression for q requires an equals sign.
- 115 Mean elements of the outer planets. Jupiter, L , 1960 Jan. 1.5.
 For $259^\circ 48' 52''.05$ read $259^\circ 49' 52''.05$
- 264 Example 9.24. After $\Delta L = -0''.90$ insert
 together with $\Delta \log_{10} r = +0.0000$ 026 instead of $\Delta \log_{10} r = +0.0000$ 011
- 367 Figure 12.6. For S Geocentric read S Planetocentric
- 396 Kuiper, 1956. For I read 2
- 442 Line 12. For Earth read equinox
- 459 Line 14. For *Achstellige* read *Achtstellige*
- 470 Table 16.3. Maximum differences in the fundamental ephemerides
 SUN Rectangular coordinates (X , Y , Z) for $\delta^4 = 2$ read $\delta^4 = 12$
- | | | | | | | | |
|------------------------|------------|------------|------------|------|------------|------------|------------|
| | δ^2 | δ^3 | δ^4 | | δ^2 | δ^3 | δ^4 |
| NUTATION in obliquity | for 82 | 32 | 20 | read | 32 | 20 | 15 |
| MOON Ephemeris transit | for 160 | 20 | 10 | read | 270 | 95 | 30 |
- 491 Dimensions and rotations of the planets Add to footnote:
 The tabulated semi-diameters are the values adopted in the Ephemeris.

CHRONOLOGICAL CYCLES AND ERAS

Dominical Letter	...	...	A	Julian Period (year of)	...	6680
Epact	...	...	19	Roman Indiction	...	5
Golden Number (Lunar Cycle)	...	...	XI	Solar Cycle	...	16

All dates are given in terms of the Gregorian calendar.

January 14 corresponds to January 1, Julian reckoning.

Julian Day 243 9492 begins at Greenwich mean noon on January 1.

ERA	YEAR	BEGINS	ERA	YEAR	BEGINS
Byzantine	7476	Sept. 14	
Jewish (A. M.)	5728	Oct. 5	
Roman (A.U.C.)	2720	Jan. 14	
Nabonassar	2716	May 2	
Japanese	2627	Jan. 1	
Grecian	2279	Sept. 14	
(Seleucidæ)		(or Oct. 14)	
Indian (Saka)	1889	Mar. 22	
Diocletian	1684	Sept. 12	
Mohammedan	1387	Apr. 11	
(Hegira)			

RELIGIOUS CALENDARS

Epiphany	...	...	...	Jan. 6	Rogation Sunday	...	...	Apr. 30
Septuagesima Sunday	...	...	...	Jan. 22	Ascension Day—	...	...
Quinquagesima (Shrove)	...	...	...		Holy Thursday	...	...	May 4
Sunday	...	...	...	Feb. 5	Whit Sunday—Pentecost	...	...	May 14
Ash Wednesday	...	...	...	Feb. 8	Trinity Sunday	...	...	May 21
Palm Sunday	...	...	...	Mar. 19	Corpus Christi	...	...	May 25
Good Friday	...	...	...	Mar. 24	First Sunday in Advent	...	...	Dec. 3
Easter Day	...	...	...	Mar. 26	Christmas Day (Monday)	...	...	Dec. 25
First day of Passover (Pesach)	...	...	...	Apr. 25	Day of Atonement	...	...
Feast of Weeks (Shebuoth)	...	...	...	June 14	(Yom Kippur)	...	...	Oct. 14
Jewish New Year (tabular)	...	...	...		First day of Tabernacles	...	...
(Rosh Hashanah)	...	...	...	Oct. 5	(Succoth)	...	...	Oct. 19
Mohammedan New Year	...	...	...	Apr. 11	First day of Ramadân	...	...	Dec. 3
(tabular)	...	...	...		(tabular)	...	...

CALENDAR, 1967

Day of Month	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE	
	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date
1-0	§.	2439 491·5	W.	2439 522·5	W.	2439 550·5	S.	2439 581·5	M.	2439 611·5	Th.	2439 642·5
2-0	M.	492·5	Th.	523·5	Th.	551·5	§.	582·5	Tu.	612·5	F.	643·5
3-0	Tu.	493·5	F.	524·5	F.	552·5	M.	583·5	W.	613·5	S.	644·5
4-0	W.	494·5	S.	525·5	S.	553·5	Tu.	584·5	Th.	614·5	§.	645·5
5-0	Th.	495·5	§.	526·5	§.	554·5	W.	585·5	F.	615·5	M.	646·5
6-0	F.	496·5	M.	527·5	M.	555·5	Th.	586·5	S.	616·5	Tu.	647·5
7-0	S.	497·5	Tu.	528·5	Tu.	556·5	F.	587·5	§.	617·5	W.	648·5
8-0	§.	498·5	W.	529·5	W.	557·5	S.	588·5	M.	618·5	Th.	649·5
9-0	M.	499·5	Th.	530·5	Th.	558·5	§.	589·5	Tu.	619·5	F.	650·5
10-0	Tu.	500·5	F.	531·5	F.	559·5	M.	590·5	W.	620·5	S.	651·5
11-0	W.	501·5	S.	532·5	S.	560·5	Tu.	591·5	Th.	621·5	§.	652·5
12-0	Th.	502·5	§.	533·5	§.	561·5	W.	592·5	F.	622·5	M.	653·5
13-0	F.	503·5	M.	534·5	M.	562·5	Th.	593·5	S.	623·5	Tu.	654·5
14-0	S.	504·5	Tu.	535·5	Tu.	563·5	F.	594·5	§.	624·5	W.	655·5
15-0	§.	505·5	W.	536·5	W.	564·5	S.	595·5	M.	625·5	Th.	656·5
16-0	M.	506·5	Th.	537·5	Th.	565·5	§.	596·5	Tu.	626·5	F.	657·5
17-0	Tu.	507·5	F.	538·5	F.	566·5	M.	597·5	W.	627·5	S.	658·5
18-0	W.	508·5	S.	539·5	S.	567·5	Tu.	598·5	Th.	628·5	§.	659·5
19-0	Th.	509·5	§.	540·5	§.	568·5	W.	599·5	F.	629·5	M.	660·5
20-0	F.	510·5	M.	541·5	M.	569·5	Th.	600·5	S.	630·5	Tu.	661·5
21-0	S.	511·5	Tu.	542·5	Tu.	570·5	F.	601·5	§.	631·5	W.	662·5
22-0	§.	512·5	W.	543·5	W.	571·5	S.	602·5	M.	632·5	Th.	663·5
23-0	M.	513·5	Th.	544·5	Th.	572·5	§.	603·5	Tu.	633·5	F.	664·5
24-0	Tu.	514·5	F.	545·5	F.	573·5	M.	604·5	W.	634·5	S.	665·5
25-0	W.	515·5	S.	546·5	S.	574·5	Tu.	605·5	Th.	635·5	§.	666·5
26-0	Th.	516·5	§.	547·5	§.	575·5	W.	606·5	F.	636·5	M.	667·5
27-0	F.	517·5	M.	548·5	M.	576·5	Th.	607·5	S.	637·5	Tu.	668·5
28-0	S.	518·5	Tu.	549·5	Tu.	577·5	F.	608·5	§.	638·5	W.	669·5
29-0	§.	519·5			W.	578·5	S.	609·5	M.	639·5	Th.	670·5
30-0	M.	520·5			Th.	579·5	§.	610·5	Tu.	640·5	F.	671·5
31-0	Tu.	521·5			F.	580·5			W.	641·5		

The Julian Day begins at noon.

The fraction of the year, τ , measured from the beginning of the Besselian solar year, is given on pages 258–272. For the first half of the year, on pages 258–264, it is measured from 1967·0 or 1967 January 1^d·041; for the second half of the year, on pages 266–272, it is measured from 1968·0 or 1968 January 1^d·283.

Day of Month	JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date
		2439		2439		2439		2439		2439		2439
1.0	S.	672.5	Tu.	703.5	F.	734.5	\$.	764.5	W.	795.5	F.	825.5
2.0	\$.	673.5	W.	704.5	S.	735.5	M.	765.5	Th.	796.5	S.	826.5
3.0	M.	674.5	Th.	705.5	\$.	736.5	Tu.	766.5	F.	797.5	\$.	827.5
4.0	Tu.	675.5	F.	706.5	M.	737.5	W.	767.5	S.	798.5	M.	828.5
5.0	W.	676.5	S.	707.5	Tu.	738.5	Th.	768.5	\$.	799.5	Tu.	829.5
6.0	Th.	677.5	\$.	708.5	W.	739.5	F.	769.5	M.	800.5	W.	830.5
7.0	F.	678.5	M.	709.5	Th.	740.5	S.	770.5	Tu.	801.5	Th.	831.5
8.0	S.	679.5	Tu.	710.5	F.	741.5	\$.	771.5	W.	802.5	F.	832.5
9.0	\$.	680.5	W.	711.5	S.	742.5	M.	772.5	Th.	803.5	S.	833.5
10.0	M.	681.5	Th.	712.5	\$.	743.5	Tu.	773.5	F.	804.5	\$.	834.5
11.0	Tu.	682.5	F.	713.5	M.	744.5	W.	774.5	S.	805.5	M.	835.5
12.0	W.	683.5	S.	714.5	Tu.	745.5	Th.	775.5	\$.	806.5	Tu.	836.5
13.0	Th.	684.5	\$.	715.5	W.	746.5	F.	776.5	M.	807.5	W.	837.5
14.0	F.	685.5	M.	716.5	Th.	747.5	S.	777.5	Tu.	808.5	Th.	838.5
15.0	S.	686.5	Tu.	717.5	F.	748.5	\$.	778.5	W.	809.5	F.	839.5
16.0	\$.	687.5	W.	718.5	S.	749.5	M.	779.5	Th.	810.5	S.	840.5
17.0	M.	688.5	Th.	719.5	\$.	750.5	Tu.	780.5	F.	811.5	\$.	841.5
18.0	Tu.	689.5	F.	720.5	M.	751.5	W.	781.5	S.	812.5	M.	842.5
19.0	W.	690.5	S.	721.5	Tu.	752.5	Th.	782.5	\$.	813.5	Tu.	843.5
20.0	Th.	691.5	\$.	722.5	W.	753.5	F.	783.5	M.	814.5	W.	844.5
21.0	F.	692.5	M.	723.5	Th.	754.5	S.	784.5	Tu.	815.5	Th.	845.5
22.0	S.	693.5	Tu.	724.5	F.	755.5	\$.	785.5	W.	816.5	F.	846.5
23.0	\$.	694.5	W.	725.5	S.	756.5	M.	786.5	Th.	817.5	S.	847.5
24.0	M.	695.5	Th.	726.5	\$.	757.5	Tu.	787.5	F.	818.5	\$.	848.5
25.0	Tu.	696.5	F.	727.5	M.	758.5	W.	788.5	S.	819.5	M.	849.5
26.0	W.	697.5	S.	728.5	Tu.	759.5	Th.	789.5	\$.	820.5	Tu.	850.5
27.0	Th.	698.5	\$.	729.5	W.	760.5	F.	790.5	M.	821.5	W.	851.5
28.0	F.	699.5	M.	730.5	Th.	761.5	S.	791.5	Tu.	822.5	Th.	852.5
29.0	S.	700.5	Tu.	731.5	F.	762.5	\$.	792.5	W.	823.5	F.	853.5
30.0	\$.	701.5	W.	732.5	S.	763.5	M.	793.5	Th.	824.5	S.	854.5
31.0	M.	702.5	Th.	733.5			Tu.	794.5			\$.	855.5

The Julian Day begins at noon.

The fraction of the year, τ , measured from the beginning of the Besselian solar year, is given on pages 258–272. For the first half of the year, on pages 258–264, it is measured from 1967.0 or 1967 January 1^d.041; for the second half of the year, on pages 266–272, it is measured from 1968.0 or 1968 January 1^d.283.

PHENOMENA, 1967

GEOCENTRIC PHENOMENA IN UNIVERSAL TIME

MERCURY

Superior conjunction	... Jan. 18 ^d 02 ^h	May 11 ^d 16 ^h	Aug. 24 ^d 16 ^h	Dec. 28 ^d 23 ^h
Greatest elongation East	Feb. 16 16 (18°)	June 12 10 (24°)	Oct. 9 04 (25°)	
Stationary	... Feb. 22 14	June 25 17	Oct. 21 10	
Inferior conjunction	... Mar. 4 08	July 9 12	Nov. 1 15	
Stationary	... Mar. 16 16	July 20 08	Nov. 10 09	
Greatest elongation West	Mar. 31 16 (28°)	July 30 03 (20°)	Nov. 17 21 (19°)	

VENUS

Greatest elongation East	June 21 ^d 00 ^h (45°)	Stationary ...	Sept. 18 ^d 20 ^h
Greatest brilliancy	July 24 10	Greatest brilliancy	Oct. 6 02
Stationary	Aug. 6 06	Greatest elongation West	Nov. 9 15 (47°)
Inferior conjunction	Aug. 29 22		

EARTH

Perihelion	... Jan. 2	Equinoxes	... Mar. 21 ^d 07 ^h 37 ^m	Sept. 23 ^d 17 ^h 38 ^m
Aphelion	... July 5	Solstices	... June 22 02 23	Dec. 22 13 17

SUPERIOR PLANETS

	Stationary	Opposition	Stationary	Conjunction
	^d ^h	^d ^h	^d ^h	^d ^h
Mars	Mar. 8 19	Apr. 15 12	May 27 15	—
Jupiter	Dec. 22 23	Jan. 20 05	Mar. 21 09	Aug. 8 19
Saturn	July 26 08	Oct. 2 22	Dec. 10 10	Mar. 23 19
Uranus	—	Mar. 13 16	May 29 06	Sept. 18 10
Neptune	Feb. 25 08	May 14 12	Aug. 4 04	Nov. 17 03
Pluto	—	Mar. 10 15	June 4 23	Sept. 13 23

HELIOCENTRIC PHENOMENA

	Perihelion	Aphelion	Ascending Node	Greatest Lat. North	Descending Node	Greatest Lat. South
Mercury	—	Jan. 3	—	—	—	Jan. 24
	Feb. 16	Apr. 1	Feb. 12	Feb. 27	Mar. 22	Apr. 22
	May 15	June 28	May 11	May 26	June 18	July 19
	Aug. 11	Sept. 24	Aug. 7	Aug. 22	Sept. 14	Oct. 15
	Nov. 7	Dec. 21	Nov. 3	Nov. 18	Dec. 11	—
Venus	—	Jan. 1	—	—	—	Jan. 23
	Apr. 23	Aug. 14	Mar. 21	May 15	July 10	Sept. 5
	Dec. 4	—	Oct. 31	Dec. 26	—	—
Mars	Dec. 4	—	—	—	June 4	Nov. 9

Jupiter, Saturn, Uranus, Neptune, Pluto: None in 1967

ECLIPSES

Total eclipse of the Moon, Apr. 24	The Americas, Asia, Australasia
Partial eclipse of the Sun, May 9	North America, North Pole, Northern Europe
Total eclipse of the Moon, Oct. 18	The Americas, Asia, Australasia
*Total eclipse of the Sun, Nov. 2	South Africa, Antarctica

* The axis of the shadow does not touch the Earth.

OCCULTATIONS OF PLANETS AND BRIGHT STARS

Date	Body	Area of Visibility	Date	Body	Area of Visibility
Jan. ^{d h} 3 19	Mars	E. Asia, Pacific	July ^{d h} 27 14	Saturn	N.E. Asia, N.W. America
31 21	Mars	Antarctica	Aug. 12 08	Mars	Asia, N. Australia
Mar. 13 21	Venus	S. America	23 20	Saturn	E. Europe, N.W. Asia
Apr. 8 15	Saturn	S. America	Sept. 9 21	Mars	Antarctica
13 06	Venus	N.E. Europe, Asia	10 12	<i>Antares</i>	N. Asia
23 17	Mars	Cent. and E. Africa, S. Australia	20 00	Saturn	Greenland, Iceland
May 6 04	Saturn	S.E. Asia, Indonesia, W. and N. Australia	Oct. 7 20	<i>Antares</i>	N.E. America
June 2 17	Saturn	New Zealand, Pacific, N. and Cent. America	17 02	Saturn	N. and Cent. America
30 04	Saturn	N. and W. Africa, S. and E. Europe, Asia	Nov. 4 05	<i>Antares</i>	N. and E. Asia
			13 04	Saturn	N. America
			Dec. 10 10	Saturn	Asia, Alaska
			29 03	<i>Antares</i>	Asia

DIARY

Jan. ^{d h} 1 10	Moon at perigee		Feb. ^{d h} 22 14	Mercury stationary	
2 05	Uranus 3° S. of Moon		23 12	Venus 1°·1 N. of Saturn	
3 14	LAST QUARTER		24 18	FULL MOON	
3 19	Mars 0°·4 S. of Moon	Occ ⁿ .	25 08	Neptune stationary	
6 15	Neptune 3° N. of Moon		25 20	Uranus 3° S. of Moon	
10 18	NEW MOON		25 21	Moon at perigee	
12 00	Venus 4° N. of Moon		28 15	Mars 2° N. of Moon	
15 23	Saturn 2° N. of Moon		Mar. 2 03	Neptune 3° N. of Moon	
16 21	Moon at apogee		3 09	LAST QUARTER	
18 02	Mercury in superior conjunction		4 08	Mercury in inferior conjunction	
18 08	Mars 5° N. of <i>Spica</i>		6 16	Juno stationary	
18 20	FIRST QUARTER		8 19	Mars stationary	
20 05	Jupiter at opposition		9 22	Mercury 8° N. of Moon	
25 18	Jupiter 4° S. of Moon		10 15	Pluto at opposition	
26 07	FULL MOON		11 04	NEW MOON	
27 04	Juno at opposition		13 01	Moon at apogee	
28 15	Moon at perigee		13 16	Uranus at opposition	
29 12	Uranus 3° S. of Moon		13 21	Venus 1° N. of Moon	Occ ⁿ .
31 21	Mars 1° N. of Moon	Occ ⁿ .	16 16	Mercury stationary	
Feb. 1 23	LAST QUARTER		19 09	FIRST QUARTER	
2 21	Neptune 3° N. of Moon		21 07	Jupiter 5° S. of Moon	
8 08	Ceres stationary		21 08	Equinox	
9 11	NEW MOON		21 09	Jupiter stationary	
10 18	Mercury 5° N. of Moon		23 19	Saturn in conjunction with Sun	
11 09	Venus 3° N. of Moon		25 05	Uranus 3° S. of Moon	
12 13	Saturn 1° N. of Moon		26 03	FULL MOON	
13 15	Moon at apogee		26 08	Moon at perigee	
16 16	Mercury greatest elong. E. (18°)		27 22	Mars 2° N. of Moon	
17 16	FIRST QUARTER		29 12	Neptune 3° N. of Moon	
21 23	Jupiter 4° S. of Moon		31 16	Mercury greatest elong. W. (28°)	

Apr.	d h			June	d h		
	1 21	LAST QUARTER			11 22	Venus 3° S. of Moon	
	4 22	Vesta stationary			12 10	Mercury greatest elong. E. (24°)	
	7 09	Mercury 2° N. of Moon			15 03	Uranus 3° S. of Moon	
	8 15	Saturn 0°·8 N. of Moon	Occ ⁿ		15 11	FIRST QUARTER	
	9 03	Moon at apogee			17 03	Mars 2° S. of Moon	
	9 22	NEW MOON			18 20	Moon at perigee	
	13 06	Venus 0°·8 S. of Moon	Occ ⁿ .		19 15	Neptune 3° N. of Moon	
	15 12	Mars at opposition			21 00	Venus greatest elong. E. (45°)	
	17 16	Jupiter 5° S. of Moon			22 02	Solstice	
	17 21	FIRST QUARTER			22 05	FULL MOON	
	18 03	Mercury 0°·5 S. of Saturn			25 17	Mercury stationary	
	21 14	Uranus 3° S. of Moon			29 19	LAST QUARTER	
	21 18	Mars nearest to Earth			30 04	Saturn 0°·4 S. of Moon	Occ ⁿ .
	23 06	Venus 7° N. of <i>Aldebaran</i>			30 20	Moon at apogee	
	23 07	Mars 4° N. of <i>Spica</i>		July	1 05	Vesta stationary	
	23 17	Mars 0°·4 N. of Moon	Occ ⁿ .		3 07	Mars 1°·4 N. of <i>Spica</i>	
	23 19	Moon at perigee			7 17	NEW MOON	
	24 12	FULL MOON	Eclipse		8 05	Venus 0°·2 S. of <i>Regulus</i>	
	25 21	Neptune 3° N. of Moon			9 10	Jupiter 5° S. of Moon	
May	1 11	LAST QUARTER			9 12	Mercury in inferior conjunction	
	6 04	Saturn 0°·5 N. of Moon	Occ ⁿ .		11 00	Venus 5° S. of Moon	
	6 11	Moon at apogee			12 10	Uranus 3° S. of Moon	
	9 15	NEW MOON	Eclipse		14 16	FIRST QUARTER	
	11 16	Mercury in superior conjunction			14 20	Moon at perigee	
	13 07	Venus 2° S. of Moon			15 01	Mars 2° S. of Moon	
	14 12	Neptune at opposition			16 21	Neptune 4° N. of Moon	
	15 04	Jupiter 5° S. of Moon			20 08	Mercury stationary	
	15 21	Vesta at opposition			21 15	FULL MOON	
	17 05	FIRST QUARTER			24 10	Venus at greatest brilliancy	
	18 21	Uranus 3° S. of Moon			26 08	Saturn stationary	
	20 16	Mars 2° S. of Moon			27 14	Saturn 0°·9 S. of Moon	Occ ⁿ .
	21 01	Mercury 7° N. of <i>Aldebaran</i>			28 14	Moon at apogee	
	22 02	Moon at perigee			29 12	LAST QUARTER	
	23 07	Neptune 3° N. of Moon			30 03	Mercury greatest elong. W. (20°)	
	23 20	FULL MOON		Aug.	4 04	Neptune stationary	
	27 15	Mars stationary			4 15	Mercury 6° S. of Moon	
	29 06	Uranus stationary			5 04	Mercury 7° S. of <i>Pollux</i>	
	31 02	LAST QUARTER			6 03	NEW MOON	
	31 13	Venus 4° S. of <i>Pollux</i>			6 06	Venus stationary	
June	2 17	Saturn 0°·1 N. of Moon	Occ ⁿ .		8 01	Venus 10° S. of Moon	
	3 02	Moon at apogee			8 19	Jupiter in conjunction with Sun	
	4 23	Pluto stationary			8 19	Uranus 3° S. of Moon	
	8 04	Pallas in conjunction with Sun			9 15	Moon at perigee	
	8 05	NEW MOON			12 08	Mars 0°·4 S. of Moon	Occ ⁿ .
	9 02	Venus 1°·8 N. of Jupiter			12 21	FIRST QUARTER	
	10 05	Mercury 3° S. of Moon			13 02	Neptune 4° N. of Moon	
	11 17	Jupiter 5° S. of Moon			20 02	FULL MOON	

Aug.	d h		Oct.	d h	
	23 12	Ceres in conjunction with Sun		26 12	LAST QUARTER
	23 20	Saturn 1° S. of Moon Occ ⁿ .		28 13	Jupiter 4° S. of Moon
	24 16	Mercury in superior conjunction		29 20	Venus 4° S. of Moon
	25 09	Moon at apogee		30 10	Uranus 2° S. of Moon
	28 06	LAST QUARTER	Nov.	1 15	Mercury in inferior conjunction
	29 13	Mars 3° S. of Neptune		2 02	Moon at perigee
	29 22	Venus in inferior conjunction		2 06	NEW MOON Eclipse
Sept.	3 00	Jupiter 4° S. of Moon		3 06	Neptune 4° N. of Moon
	4 00	Venus 10° S. of <i>Regulus</i>		4 05	<i>Antares</i> 1° S. of Moon Occ ⁿ .
	4 12	NEW MOON		6 09	Mars 3° N. of Moon
	6 03	Mercury $0^{\circ}.3$ N. of Uranus		7 10	Venus $0^{\circ}.1$ S. of Uranus
	6 08	Moon at perigee		9 01	FIRST QUARTER
	9 09	Neptune 4° N. of Moon		9 15	Venus greatest elong. W. (47°)
	9 21	Mars 1° N. of Moon Occ ⁿ .		10 09	Mercury stationary
	10 12	<i>Antares</i> 1° S. of Moon Occ ⁿ .		13 04	Saturn $0^{\circ}.8$ S. of Moon Occ ⁿ .
	11 03	FIRST QUARTER		15 08	Moon at apogee
	13 23	Pluto in conjunction with Sun		17 03	Neptune in conjunction with Sun
	18 10	Uranus in conjunction with Sun		17 05	FULL MOON
	18 17	FULL MOON		17 21	Mercury greatest elong. W. (19°)
	18 20	Venus stationary		25 00	LAST QUARTER
	20 00	Saturn 1° S. of Moon Occ ⁿ .		25 03	Jupiter 4° S. of Moon
	22 00	Moon at apogee		26 21	Uranus 2° S. of Moon
	23 07	Mars 3° N. of <i>Antares</i>		28 11	Venus 2° N. of Moon
	23 18	Equinox		30 01	Venus 5° N. of <i>Spica</i>
	24 21	Mercury $0^{\circ}.8$ N. of <i>Spica</i>		30 14	Moon at perigee
	25 11	Juno in conjunction with Sun		30 16	Mercury 4° N. of Moon
	26 22	LAST QUARTER	Dec.	1 16	NEW MOON
	30 20	Jupiter 4° S. of Moon		2 03	Mercury $0^{\circ}.6$ S. of Neptune
	30 21	Venus 10° S. of Moon		5 08	Mars 4° N. of Moon
Oct.	2 20	Uranus 2° S. of Moon		8 18	FIRST QUARTER
	2 22	Saturn at opposition		10 10	Saturn $0^{\circ}.8$ S. of Moon Occ ⁿ .
	3 20	NEW MOON		10 10	Saturn stationary
	4 05	Venus 5° S. of <i>Regulus</i>		12 18	Moon at apogee
	4 14	Moon at perigee		16 23	FULL MOON
	5 14	Mercury 2° S. of Moon		22 11	Jupiter 3° S. of Moon
	6 02	Venus at greatest brilliancy		22 13	Solstice
	6 18	Neptune 4° N. of Moon		22 23	Jupiter stationary
	7 20	<i>Antares</i> 1° S. of Moon Occ ⁿ .		24 05	Uranus 2° S. of Moon
	8 13	Mars 3° N. of Moon		24 11	LAST QUARTER
	9 04	Mercury greatest elong. E. (25°)		28 05	Venus 5° N. of Moon
	10 12	FIRST QUARTER		28 07	Neptune 4° N. of Moon
	15 01	Jupiter $0^{\circ}.3$ N. of <i>Regulus</i>		28 19	Moon at perigee
	17 02	Saturn 1° S. of Moon Occ ⁿ .		28 23	Mercury in superior conjunction
	18 10	FULL MOON Eclipse		29 02	Venus $0^{\circ}.7$ N. of Neptune
	19 08	Moon at apogee		29 03	<i>Antares</i> 1° S. of Moon Occ ⁿ .
	21 10	Mercury stationary		31 04	NEW MOON

ELONGATIONS AND MAGNITUDES OF PLANETS AT 0^h U.T

Date	Mercury		Venus		Date	Mercury		Venus	
	Elong.	Mag.	Elong.	Mag.		Elong.	Mag.	Elong.	Mag.
Jan. 0	W. 10°	-0.5	E. 13°	-3.4	July 4	E. 9°	+2.6	E. 45°	-4.1
5	8	0.6	14	3.4	9	E. 5	3.1	44	4.1
10	5	0.7	15	3.3	14	W. 9	2.6	43	4.1
15	W. 3	0.9	16	3.3	19	14	1.9	41	4.2
20	E. 2	1.0	17	3.3	24	18	1.2	39	4.2
25	E. 5	-1.0	E. 18	-3.3	29	W. 20	+0.5	E. 37	-4.2
30	8	1.0	20	3.3	Aug. 3	19	-0.1	34	4.1
Feb. 4	12	1.0	21	3.3	8	16	0.7	30	4.1
9	15	0.9	22	3.3	13	12	1.1	25	3.9
14	18	-0.5	23	3.3	18	7	1.4	19	3.7
19	E. 18	+0.1	E. 24	-3.3	23	W. 3	-1.5	E. 13	-3.4
24	14	1.0	25	3.4	28	E. 4	1.3	E. 9	3.2
Mar. 1	E. 7	2.2	27	3.4	Sept. 2	8	0.9	W. 10	3.3
6	W. 5	2.7	28	3.4	7	12	0.6	15	3.6
11	13	1.9	29	3.4	12	15	0.4	21	3.8
16	W. 20	+1.3	E. 30	-3.4	17	E. 18	-0.2	W. 26	-4.0
21	25	0.9	31	3.4	22	21	0.0	31	4.2
26	27	0.7	32	3.4	27	23	+0.1	35	4.2
31	28	0.5	33	3.4	Oct. 2	24	0.1	38	4.3
Apr. 5	27	0.4	34	3.5	7	25	0.2	41	4.3
10	W. 26	+0.3	E. 35	-3.5	12	E. 25	+0.3	W. 43	-4.3
15	24	+0.1	36	3.5	17	24	0.5	44	4.2
20	21	-0.1	37	3.5	22	20	0.8	45	4.2
25	17	0.4	38	3.5	27	12	1.6	46	4.2
30	13	0.8	39	3.6	Nov. 1	E. 2	3.0	46	4.1
May 5	W. 8	-1.3	E. 40	-3.6	6	W. 9	+1.7	W. 47	-4.1
10	W. 2	1.8	41	3.6	11	17	+0.5	47	4.0
15	E. 4	1.7	42	3.6	16	19	-0.2	47	4.0
20	10	1.3	43	3.7	21	19	0.5	46	3.9
25	15	0.8	43	3.7	26	17	0.5	46	3.9
30	E. 19	-0.3	E. 44	-3.7	Dec. 1	W. 15	-0.6	W. 45	-3.8
June 4	22	+0.1	45	3.8	6	13	0.6	45	3.8
9	24	0.5	45	3.8	11	10	0.6	44	3.8
14	24	0.8	45	3.9	16	7	0.6	43	3.7
19	23	1.2	45	3.9	21	5	0.7	43	3.7
24	E. 20	+1.5	E. 45	-4.0	26	W. 2	-0.8	W. 42	-3.7
29	15	2.0	45	4.0	31	E. 2	0.8	41	3.6
July 4	E. 9	+2.6	E. 45	-4.1	36	E. 5	-0.8	W. 40	-3.6

MINOR PLANETS

		Stationary	Opposition	Stationary	Conjunction
Ceres	...	—	—	Feb. 8	Aug. 23
Pallas	...	—	—	—	June 8
Juno	...	—	Jan. 27	Mar. 6	Sept. 25
Vesta	...	Apr. 4	May 15	July 1	—

ELONGATIONS AND MAGNITUDES OF PLANETS AT 0^h U.T.

Date	Mars		Jupiter		Saturn		Uranus	Neptune	Pluto
	Elong.	Mag.	Elong.	Mag.	Elong.	Mag.	Elong.	Elong.	Elong.
Jan. 0	W. 85°	+1.1	W. 157°	-2.1	E. 75°	+1.4	W. 104°	W. 45°	W. 108°
10	91	1.0	168	2.2	66	1.4	115	55	118
20	97	0.8	W. 179	2.2	56	1.4	125	65	127
30	103	0.6	E. 169	2.2	47	1.3	135	75	137
Feb. 9	110	0.4	157	2.1	38	1.3	146	85	146
19	W. 118	+0.1	E. 146	-2.1	E. 29	+1.3	W. 156	W. 95	W. 155
Mar. 1	127	-0.1	135	2.0	20	1.2	167	105	W. 162
11	136	0.4	125	2.0	11	1.2	W. 177	115	E. 165
21	147	0.7	115	1.9	E. 3	1.2	E. 172	125	161
31	159	1.0	105	1.8	W. 7	1.1	162	135	154
Apr. 10	W. 172	-1.2	E. 96	-1.8	W. 15	+1.1	E. 152	W. 145	E. 146
20	E. 174	1.3	87	1.7	23	1.1	142	155	137
30	161	1.2	78	1.6	32	1.1	132	165	128
May 10	148	1.0	69	1.6	41	1.1	122	W. 175	119
20	137	0.8	61	1.5	49	1.1	112	E. 174	109
30	E. 127	-0.6	E. 53	-1.5	W. 58	+1.1	E. 102	E. 165	E. 100
June 9	119	0.4	45	1.4	67	1.0	93	155	90
19	111	-0.2	38	1.4	76	1.0	83	145	81
29	105	0.0	30	1.3	85	1.0	74	135	72
July 9	99	+0.1	23	1.3	94	1.0	65	126	63
19	E. 94	+0.3	E. 15	-1.3	W. 103	+0.9	E. 56	E. 116	E. 55
29	89	0.4	8	1.3	113	0.9	47	106	46
Aug. 8	85	0.5	E. 1	1.3	122	0.8	38	97	37
18	81	0.6	W. 7	1.3	132	0.7	29	87	29
28	78	0.7	14	1.3	142	0.7	20	78	21
Sept. 7	E. 74	+0.7	W. 22	-1.3	W. 153	+0.6	E. 11	E. 68	E. 16
17	71	0.8	29	1.3	163	0.6	E. 2	59	W. 15
27	68	0.9	37	1.4	W. 173	0.6	W. 8	49	19
Oct. 7	65	0.9	45	1.4	E. 175	0.6	17	40	26
17	63	1.0	53	1.4	165	0.6	26	30	35
27	E. 60	+1.0	W. 62	-1.5	E. 154	+0.7	W. 36	E. 20	W. 43
Nov. 6	58	1.0	70	1.5	144	0.8	45	11	52
16	55	1.1	79	1.6	133	0.8	55	E. 2	61
26	52	1.1	88	1.7	123	0.9	64	W. 9	71
Dec. 6	50	1.2	98	1.7	113	0.9	74	19	81
16	E. 48	+1.2	W. 108	-1.8	E. 102	+1.0	W. 84	W. 28	W. 91
26	45	1.2	118	1.9	92	1.0	94	38	100
36	E. 43	+1.3	W. 128	-1.9	E. 83	+1.1	W. 104	W. 48	W. 110

Magnitudes at opposition: Uranus 5.7 Neptune 7.7 Pluto 15

VISUAL MAGNITUDES OF MINOR PLANETS

	Jan. 10	Feb. 19	Mar. 31	May 10	June 19	July 29	Sept. 7	Oct. 17	Nov. 26	Dec. 36
Ceres	6.6	7.0	7.5	7.8	8.0	8.1	8.2	8.1	7.8	7.5
Pallas	8.6	8.8	8.9	8.8	8.7	8.6	8.4	8.2	7.8	7.4
Juno	7.9	8.2	8.9	9.6	10.2	10.6	10.8	10.9	10.9	10.7
Vesta	7.2	6.6	6.0	5.6	5.7	6.3	6.8	7.3	7.6	7.8

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries			
		Apparent	Mean			Apparent	Mean		
		^h ^m ^s	^s	^s		^d ^h ^m ^s	^s		
Jan.	0	2439			2446	Jan.	0 17 21 15.794	15.122	
	1	490.5	6 35 53.152	53.827	-0.675	171.0	1 17 17 19.885	19.213	
	2	491.5	6 39 49.709	50.382	-673	172.0	2 17 13 23.978	23.303	
	3	492.5	6 43 46.263	46.937	-675	173.0	3 17 09 28.071	27.394	
	4	493.5	6 47 42.815	43.493	-677	174.0	4 17 05 32.164	31.484	
	5	494.5	6 51 39.368	40.048	-680	175.0			
	6	495.5	6 55 35.922	36.603	-0.681	176.0	5 17 01 36.253	35.575	
	7	496.5	6 59 32.479	33.159	-680	177.0	6 16 57 40.340	39.665	
	8	497.5	7 03 29.040	29.714	-675	178.0	7 16 53 44.423	43.756	
	9	498.5	7 07 25.603	26.270	-667	179.0	8 16 49 48.505	47.846	
	10	499.5	7 11 22.167	22.825	-658	180.0	9 16 45 52.586	51.937	
	11	500.5	7 15 18.732	19.380	-0.648	181.0	10 16 41 56.668	56.028	
	12	501.5	7 19 15.296	15.936	-640	182.0	11 16 38 00.752	00.118	
	13	502.5	7 23 11.857	12.491	-634	183.0	12 16 34 04.838	04.209	
	14	503.5	7 27 08.416	09.046	-630	184.0	13 16 30 08.927	08.299	
	15	504.5	7 31 04.972	05.602	-630	185.0	14 16 26 13.018	12.390	
	16	505.5	7 35 01.526	02.157	-0.631	186.0	15 16 22 17.112	16.480	
	17	506.5	7 38 58.078	58.712	-634	187.0	16 16 18 21.206	20.571	
	18	507.5	7 42 54.630	55.268	-638	188.0	17 16 14 25.300	24.661	
	19	508.5	7 46 51.182	51.823	-642	189.0	18 16 10 29.394	28.752	
	20	509.5	7 50 47.734	48.379	-644	190.0	19 16 06 33.485	32.842	
	21	510.5	7 54 44.289	44.934	-0.645	191.0	20 16 02 37.575	36.933	
	22	511.5	7 58 40.846	41.489	-643	192.0	21 15 58 41.662	41.023	
	23	512.5	8 02 37.406	38.045	-639	193.0	22 15 54 45.746	45.114	
	24	513.5	8 06 33.968	34.600	-632	194.0	23 15 50 49.829	49.204	
	25	514.5	8 10 30.532	31.155	-623	195.0	24 15 46 53.910	53.295	
	26	515.5	8 14 27.097	27.711	-0.614	196.0	25 15 42 57.993	57.386	
	27	516.5	8 18 23.660	24.266	-606	197.0	26 15 39 02.077	01.476	
	28	517.5	8 22 20.220	20.821	-601	198.0	27 15 35 06.165	05.567	
	29	518.5	8 26 16.777	17.377	-600	199.0	28 15 31 10.257	09.657	
	30	519.5	8 30 13.330	13.932	-603	200.0	29 15 27 14.352	13.748	
	31	520.5	8 34 09.880	10.488	-0.607	201.0	30 15 23 18.447	17.838	
	1	521.5	8 38 06.431	07.043	-612	202.0	31 15 19 22.542	21.929	
	2	522.5	8 42 02.982	03.598	-616	203.0	1 15 15 26.634	26.019	
	3	523.5	8 45 59.537	60.154	-617	204.0	2 15 11 30.724	30.110	
	4	524.5	8 49 56.094	56.709	-615	205.0	3 15 07 34.811	34.200	
	5	525.5	8 53 52.654	53.264	-0.610	206.0	4 15 03 38.895	38.291	
	6	526.5	8 57 49.216	49.820	-604	207.0	5 14 59 42.979	42.381	
	7	527.5	9 01 45.778	46.375	-597	208.0	6 14 55 47.063	46.472	
	8	528.5	9 05 42.340	42.930	-591	209.0	7 14 51 51.149	50.563	
	9	529.5	9 09 38.899	39.486	-586	210.0	8 14 47 55.236	54.653	
	10	530.5	9 13 35.457	36.041	-0.585	211.0	9 14 43 59.327	58.744	
	11	531.5	9 17 32.011	32.597	-586	212.0	10 14 40 03.420	02.834	
	12	532.5	9 21 28.563	29.152	-589	213.0	11 14 36 07.515	06.925	
	13	533.5	9 25 25.113	25.707	-594	214.0	12 14 32 11.612	11.015	
	14	534.5	9 29 21.662	22.263	-601	215.0	13 14 28 15.709	15.106	
	15	535.5	9 33 18.211	18.818	-0.607	216.0	14 14 24 19.805	19.196	
	16	536.5	9 37 14.761	15.373	-0.613	217.0	15 14 20 23.900	23.287	

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries	
		Apparent	Mean			Apparent	Mean
	2439				2446		
Feb. 15	536.5	^h 9 ^m 37 ^s 14.761	^s 15.373	-0.613	217.0	Feb. 15 ^d 15 ^h 14 ^m 20 ^s 23.900	^s 23.287
16	537.5	9 41 11.312	11.929	.617	218.0	16 14 16 27.994	27.377
17	538.5	9 45 07.866	08.484	.618	219.0	17 14 12 32.084	31.468
18	539.5	9 49 04.422	05.039	.618	220.0	18 14 08 36.173	35.558
19	540.5	9 53 00.980	01.595	.614	221.0	19 14 04 40.259	39.649
20	541.5	9 56 57.541	58.150	-0.609	222.0	20 14 00 44.343	43.739
21	542.5	10 00 54.102	54.706	.603	223.0	21 13 56 48.428	47.830
22	543.5	10 04 50.664	51.261	.597	224.0	22 13 52 52.514	51.921
23	544.5	10 08 47.223	47.816	.594	225.0	23 13 48 56.602	56.011
24	545.5	10 12 43.778	44.372	.593	226.0	24 13 45 00.695	00.102
25	546.5	10 16 40.330	40.927	-0.597	227.0	25 13 41 04.791	04.192
26	547.5	10 20 36.879	37.482	.603	228.0	26 13 37 08.889	08.283
27	548.5	10 24 33.427	34.038	.611	229.0	27 13 33 12.986	12.373
28	549.5	10 28 29.976	30.593	.617	230.0	28 13 29 17.082	16.464
Mar. 1	550.5	10 32 26.527	27.149	.621	231.0	Mar. 1 13 25 21.175	20.554
2	551.5	10 36 23.081	23.704	-0.622	232.0	2 13 21 25.264	24.645
3	552.5	10 40 19.639	20.259	.620	233.0	3 13 17 29.352	28.735
4	553.5	10 44 16.199	16.815	.616	234.0	4 13 13 33.437	32.826
5	554.5	10 48 12.759	13.370	.611	235.0	5 13 09 37.523	36.916
6	555.5	10 52 09.319	09.925	.607	236.0	6 13 05 41.610	41.007
7	556.5	10 56 05.876	06.481	-0.604	237.0	7 13 01 45.700	45.097
8	557.5	11 00 02.432	03.036	.604	238.0	8 12 57 49.791	49.188
9	558.5	11 03 58.985	59.591	.606	239.0	9 12 53 53.886	53.279
10	559.5	11 07 55.535	56.147	.611	240.0	10 12 49 57.982	57.369
11	560.5	11 11 52.084	52.702	.618	241.0	11 12 46 02.080	01.460
12	561.5	11 15 48.631	49.258	-0.626	242.0	12 12 42 06.179	05.550
13	562.5	11 19 45.178	45.813	.635	243.0	13 12 38 10.278	09.641
14	563.5	11 23 41.726	42.368	.642	244.0	14 12 34 14.375	13.731
15	564.5	11 27 38.275	38.924	.648	245.0	15 12 30 18.471	17.822
16	565.5	11 31 34.827	35.479	.652	246.0	16 12 26 22.564	21.912
17	566.5	11 35 31.381	32.034	-0.654	247.0	17 12 22 26.655	26.003
18	567.5	11 39 27.937	28.590	.653	248.0	18 12 18 30.743	30.093
19	568.5	11 43 24.495	25.145	.650	249.0	19 12 14 34.830	34.184
20	569.5	11 47 21.055	21.700	.646	250.0	20 12 10 38.916	38.274
21	570.5	11 51 17.614	18.256	.642	251.0	21 12 06 43.003	42.365
22	571.5	11 55 14.173	14.811	-0.638	252.0	22 12 02 47.091	46.455
23	572.5	11 59 10.729	11.367	.638	253.0	23 11 58 51.183	50.546
24	573.5	12 03 07.281	07.922	.641	254.0	24 11 54 55.278	54.637
25	574.5	12 07 03.831	04.477	.647	255.0	25 11 50 59.376	58.727
26	575.5	12 11 00.378	01.033	.655	256.0	26 11 47 03.475	02.818
27	576.5	12 14 56.925	57.588	-0.663	257.0	27 11 43 07.573	06.908
28	577.5	12 18 53.475	54.143	.669	258.0	28 11 39 11.667	10.999
29	578.5	12 22 50.027	50.699	.671	259.0	29 11 35 15.758	15.089
30	579.5	12 26 46.584	47.254	.670	260.0	30 11 31 19.846	19.180
31	580.5	12 30 43.143	43.809	.666	261.0	31 11 27 23.932	23.270
Apr. 1	581.5	12 34 39.704	40.365	-0.661	262.0	Apr. 1 11 23 28.017	27.361
2	582.5	12 38 36.264	36.920	-0.656	263.0	2 11 19 32.104	31.451

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries	
		Apparent	Mean			Apparent	Mean
Apr.	2439				2446		
	1 581.5	^h 12 ^m 34 ^s 39.704	^s 40.365	−0.661	262.0	Apr. 1 ^d 11 ^h 23 ^m 28.017	^s 27.361
	2 582.5	12 38 36.264	36.920	.656	263.0	2 11 19 32.104	31.451
	3 583.5	12 42 32.823	33.476	.653	264.0	3 11 15 36.192	35.542
	4 584.5	12 46 29.379	30.031	.652	265.0	4 11 11 40.283	39.632
	5 585.5	12 50 25.933	26.586	.654	266.0	5 11 07 44.376	43.723
	6 586.5	12 54 22.484	23.142	−0.658	267.0	6 11 03 48.472	47.814
	7 587.5	12 58 19.033	19.697	.664	268.0	7 10 59 52.570	51.904
	8 588.5	13 02 15.581	16.252	.672	269.0	8 10 55 56.668	55.995
	9 589.5	13 06 12.128	12.808	.679	270.0	9 10 52 00.766	00.085
	10 590.5	13 10 08.676	09.363	.687	271.0	10 10 48 04.864	04.176
	11 591.5	13 14 05.226	05.918	−0.693	272.0	11 10 44 08.959	08.266
	12 592.5	13 18 01.777	02.474	.697	273.0	12 10 40 13.053	12.357
	13 593.5	13 21 58.331	59.029	.698	274.0	13 10 36 17.144	16.447
	14 594.5	13 25 54.887	55.585	.697	275.0	14 10 32 21.232	20.538
	15 595.5	13 29 51.446	52.140	.694	276.0	15 10 28 25.319	24.628
	16 596.5	13 33 48.006	48.695	−0.690	277.0	16 10 24 29.404	28.719
	17 597.5	13 37 44.566	45.251	.685	278.0	17 10 20 33.490	32.809
	18 598.5	13 41 41.126	41.806	.680	279.0	18 10 16 37.577	36.900
	19 599.5	13 45 37.683	38.361	.678	280.0	19 10 12 41.667	40.990
	20 600.5	13 49 34.238	34.917	.679	281.0	20 10 08 45.759	45.081
	21 601.5	13 53 30.790	31.472	−0.682	282.0	21 10 04 49.855	49.172
	22 602.5	13 57 27.339	28.027	.689	283.0	22 10 00 53.952	53.262
	23 603.5	14 01 23.887	24.583	.696	284.0	23 09 56 58.049	57.353
	24 604.5	14 05 20.437	21.138	.701	285.0	24 09 53 02.144	01.443
	25 605.5	14 09 16.990	17.694	.704	286.0	25 09 49 06.235	05.534
	26 606.5	14 13 13.547	14.249	−0.702	287.0	26 09 45 10.323	09.624
	27 607.5	14 17 10.107	10.804	.697	288.0	27 09 41 14.407	13.715
	28 608.5	14 21 06.670	07.360	.690	289.0	28 09 37 18.490	17.805
	29 609.5	14 25 03.232	03.915	.683	290.0	29 09 33 22.574	21.896
	30 610.5	14 28 59.794	60.470	.676	291.0	30 09 29 26.659	25.986
May	1 611.5	14 32 56.353	57.026	−0.672	292.0	May 1 09 25 30.747	30.077
	2 612.5	14 36 52.910	53.581	.671	293.0	2 09 21 34.837	34.167
	3 613.5	14 40 49.464	50.136	.673	294.0	3 09 17 38.930	38.258
	4 614.5	14 44 46.015	46.692	.676	295.0	4 09 13 43.025	42.348
	5 615.5	14 48 42.565	43.247	.682	296.0	5 09 09 47.121	46.439
	6 616.5	14 52 39.115	39.803	−0.688	297.0	6 09 05 51.217	50.530
	7 617.5	14 56 35.665	36.358	.693	298.0	7 09 01 55.313	54.620
	8 618.5	15 00 32.216	32.913	.697	299.0	8 08 57 59.407	58.711
	9 619.5	15 04 28.769	29.469	.700	300.0	9 08 54 03.499	02.801
	10 620.5	15 08 25.324	26.024	.700	301.0	10 08 50 07.589	06.892
	11 621.5	15 12 21.882	22.579	−0.697	302.0	11 08 46 11.676	10.982
	12 622.5	15 16 18.442	19.135	.692	303.0	12 08 42 15.761	15.073
	13 623.5	15 20 15.004	15.690	.686	304.0	13 08 38 19.845	19.163
	14 624.5	15 24 11.567	12.245	.679	305.0	14 08 34 23.928	23.254
	15 625.5	15 28 08.129	08.801	.672	306.0	15 08 30 28.013	27.344
	16 626.5	15 32 04.689	05.356	−0.667	307.0	16 08 26 32.099	31.435
	17 627.5	15 36 01.247	01.912	−0.665	308.0	17 08 22 36.189	35.525

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries	
		Apparent	Mean			Apparent	Mean
	2439	^h ^m ^s	^s	^s	2446	^d ^h ^m ^s	^s
May 17	627.5	15 36 01.247	01.912	-0.665	308.0	May 17 08 22 36.189	35.525
18	628.5	15 39 57.801	58.467	.666	309.0	18 08 18 40.281	39.616
19	629.5	15 43 54.353	55.022	.669	310.0	19 08 14 44.375	43.706
20	630.5	15 47 50.904	51.578	.674	311.0	20 08 10 48.471	47.797
21	631.5	15 51 47.455	48.133	.678	312.0	21 08 06 52.565	51.888
22	632.5	15 55 44.009	44.688	-0.680	313.0	22 08 02 56.656	55.978
23	633.5	15 59 40.566	41.244	.678	314.0	23 07 59 00.743	00.069
24	634.5	16 03 37.127	37.799	.672	315.0	24 07 55 04.826	04.159
25	635.5	16 07 33.691	34.354	.663	316.0	25 07 51 08.907	08.250
26	636.5	16 11 30.257	30.910	.653	317.0	26 07 47 12.988	12.340
27	637.5	16 15 26.822	27.465	-0.644	318.0	27 07 43 17.070	16.431
28	638.5	16 19 23.384	24.021	.636	319.0	28 07 39 21.154	20.521
29	639.5	16 23 19.944	20.576	.632	320.0	29 07 35 25.241	24.612
30	640.5	16 27 16.501	17.131	.630	321.0	30 07 31 29.331	28.702
31	641.5	16 31 13.056	13.687	.631	322.0	31 07 27 33.423	32.793
June 1	642.5	16 35 09.608	10.242	-0.634	323.0	June 1 07 23 37.517	36.883
2	643.5	16 39 06.160	06.797	.637	324.0	2 07 19 41.611	40.974
3	644.5	16 43 02.712	03.353	.641	325.0	3 07 15 45.705	45.065
4	645.5	16 46 59.264	59.908	.644	326.0	4 07 11 49.798	49.155
5	646.5	16 50 55.818	56.463	.645	327.0	5 07 07 53.889	53.246
6	647.5	16 54 52.375	53.019	-0.644	328.0	6 07 03 57.977	57.336
7	648.5	16 58 48.934	49.574	.640	329.0	7 07 00 02.063	01.427
8	649.5	17 02 45.496	46.130	.634	330.0	8 06 56 06.147	05.517
9	650.5	17 06 42.059	42.685	.626	331.0	9 06 52 10.229	09.608
10	651.5	17 10 38.623	39.240	.617	332.0	10 06 48 14.311	13.698
11	652.5	17 14 35.187	35.796	-0.608	333.0	11 06 44 18.393	17.789
12	653.5	17 18 31.750	32.351	.601	334.0	12 06 40 22.478	21.879
13	654.5	17 22 28.309	28.906	.597	335.0	13 06 36 26.565	25.970
14	655.5	17 26 24.866	25.462	.596	336.0	14 06 32 30.655	30.060
15	656.5	17 30 21.420	22.017	.597	337.0	15 06 28 34.747	34.151
16	657.5	17 34 17.972	18.572	-0.600	338.0	16 06 24 38.841	38.241
17	658.5	17 38 14.525	15.128	.603	339.0	17 06 20 42.934	42.332
18	659.5	17 42 11.078	11.683	.605	340.0	18 06 16 47.026	46.423
19	660.5	17 46 07.635	08.239	.603	341.0	19 06 12 51.114	50.513
20	661.5	17 50 04.196	04.794	.598	342.0	20 06 08 55.198	54.604
21	662.5	17 54 00.760	01.349	-0.589	343.0	21 06 04 59.279	58.694
22	663.5	17 57 57.326	57.905	.579	344.0	22 06 01 03.359	02.785
23	664.5	18 01 53.892	54.460	.568	345.0	23 05 57 07.439	06.875
24	665.5	18 05 50.457	51.015	.559	346.0	24 05 53 11.521	10.966
25	666.5	18 09 47.019	47.571	.552	347.0	25 05 49 15.606	15.056
26	667.5	18 13 43.577	44.126	-0.549	348.0	26 05 45 19.694	19.147
27	668.5	18 17 40.133	40.681	.548	349.0	27 05 41 23.784	23.237
28	669.5	18 21 36.687	37.237	.550	350.0	28 05 37 27.877	27.328
29	670.5	18 25 33.239	33.792	.553	351.0	29 05 33 31.970	31.418
30	671.5	18 29 29.791	30.348	.556	352.0	30 05 29 36.064	35.509
July 1	672.5	18 33 26.344	26.903	-0.559	353.0	July 1 05 25 40.157	39.599
2	673.5	18 37 22.898	23.458	-0.560	354.0	2 05 21 44.249	43.690

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries	
		Apparent	Mean			Apparent	Mean
July	2439	^h ^m ^s	^s	^s	2446	^d ^h ^m ^s	^s
	1 672.5	18 33 26.344	26.903	-0.559	353.0	July 1 05 25 40.157	39.599
	2 673.5	18 37 22.898	23.458	.560	354.0	2 05 21 44.249	43.690
	3 674.5	18 41 19.454	20.014	.560	355.0	3 05 17 48.338	47.781
	4 675.5	18 45 16.013	16.569	.557	356.0	4 05 13 52.425	51.871
	5 676.5	18 49 12.573	13.124	.551	357.0	5 05 09 56.510	55.962
	6 677.5	18 53 09.137	09.680	-0.543	358.0	6 05 06 00.592	00.052
	7 678.5	18 57 05.701	06.235	.534	359.0	7 05 02 04.674	04.143
	8 679.5	19 01 02.265	02.790	.525	360.0	8 04 58 08.755	08.233
	9 680.5	19 04 58.828	59.346	.518	361.0	9 04 54 12.839	12.324
	10 681.5	19 08 55.388	55.901	.513	362.0	10 04 50 16.925	16.414
	11 682.5	19 12 51.945	52.457	-0.511	363.0	11 04 46 21.015	20.505
	12 683.5	19 16 48.500	49.012	.512	364.0	12 04 42 25.107	24.595
	13 684.5	19 20 45.052	45.567	.516	365.0	13 04 38 29.201	28.686
	14 685.5	19 24 41.603	42.123	.520	366.0	14 04 34 33.295	32.776
	15 686.5	19 28 38.156	38.678	.522	367.0	15 04 30 37.388	36.867
	16 687.5	19 32 34.711	35.233	-0.522	368.0	16 04 26 41.478	40.957
	17 688.5	19 36 31.270	31.789	.519	369.0	17 04 22 45.565	45.048
	18 689.5	19 40 27.831	28.344	.513	370.0	18 04 18 49.648	49.139
	19 690.5	19 44 24.396	24.899	.504	371.0	19 04 14 53.730	53.229
	20 691.5	19 48 20.961	21.455	.494	372.0	20 04 10 57.811	57.320
	21 692.5	19 52 17.525	18.010	-0.486	373.0	21 04 07 01.893	01.410
	22 693.5	19 56 14.086	14.566	.479	374.0	22 04 03 05.978	05.501
	23 694.5	20 00 10.645	11.121	.476	375.0	23 03 59 10.065	09.591
	24 695.5	20 04 07.201	07.676	.475	376.0	24 03 55 14.156	13.682
	25 696.5	20 08 03.754	04.232	.478	377.0	25 03 51 18.249	17.772
	26 697.5	20 12 00.305	00.787	-0.482	378.0	26 03 47 22.344	21.863
	27 698.5	20 15 56.856	57.342	.487	379.0	27 03 43 26.439	25.953
	28 699.5	20 19 53.407	53.898	.491	380.0	28 03 39 30.534	30.044
	29 700.5	20 23 49.959	50.453	.495	381.0	29 03 35 34.628	34.134
	30 701.5	20 27 46.512	47.008	.496	382.0	30 03 31 38.720	38.225
Aug.	31 702.5	20 31 43.068	43.564	-0.495	383.0	31 03 27 42.809	42.316
	1 703.5	20 35 39.627	40.119	.492	384.0	Aug. 1 03 23 46.896	46.406
	2 704.5	20 39 36.188	36.675	.487	385.0	2 03 19 50.981	50.497
	3 705.5	20 43 32.750	33.230	.480	386.0	3 03 15 55.065	54.587
	4 706.5	20 47 29.312	29.785	.473	387.0	4 03 11 59.148	58.678
	5 707.5	20 51 25.874	26.341	-0.466	388.0	5 03 08 03.232	02.768
	6 708.5	20 55 22.434	22.896	.462	389.0	6 03 04 07.319	06.859
	7 709.5	20 59 18.991	19.451	.461	390.0	7 03 00 11.409	10.949
	8 710.5	21 03 15.544	16.007	.463	391.0	8 02 56 15.502	15.040
	9 711.5	21 07 12.094	12.562	.468	392.0	9 02 52 19.598	19.130
	10 712.5	21 11 08.644	09.117	-0.474	393.0	10 02 48 23.694	23.221
	11 713.5	21 15 05.194	05.673	.479	394.0	11 02 44 27.790	27.311
	12 714.5	21 19 01.746	02.228	.482	395.0	12 02 40 31.883	31.402
	13 715.5	21 22 58.302	58.784	.481	396.0	13 02 36 35.972	35.492
	14 716.5	21 26 54.861	55.339	.478	397.0	14 02 32 40.059	39.583
	15 717.5	21 30 51.423	51.894	-0.472	398.0	15 02 28 44.143	43.674
	16 718.5	21 34 47.985	48.450	.465	399.0	16 02 24 48.227	47.764
	17 719.5	21 38 44.547	45.005	-0.458	400.0	17 02 20 52.311	51.855

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries	
		Apparent	Mean			Apparent	Mean
	2439	^h ^m ^s	^s		2446	^d ^h ^m ^s	^s
Aug. 16	718.5	21 34 47.985	48.450	-0.465	400.0	Aug. 17 02 20 52.311	51.855
17	719.5	21 38 44.547	45.005	.458	401.0	18 02 16 56.397	55.945
18	720.5	21 42 41.107	41.560	.453	402.0	19 02 13 00.486	00.036
19	721.5	21 46 37.664	38.116	.451	403.0	20 02 09 04.577	04.126
20	722.5	21 50 34.219	34.671	.452	404.0	21 02 05 08.672	08.217
21	723.5	21 54 30.770	31.226	-0.456	405.0	22 02 01 12.768	12.307
22	724.5	21 58 27.320	27.782	.462	406.0	23 01 57 16.866	16.398
23	725.5	22 02 23.869	24.337	.469	407.0	24 01 53 20.963	20.488
24	726.5	22 06 20.417	20.893	.476	408.0	25 01 49 25.060	24.579
25	727.5	22 10 16.966	17.448	.482	409.0	26 01 45 29.155	28.669
26	728.5	22 14 13.517	14.003	-0.486	410.0	27 01 41 33.247	32.760
27	729.5	22 18 10.070	10.559	.489	411.0	28 01 37 37.338	36.850
28	730.5	22 22 06.626	07.114	.488	412.0	29 01 33 41.426	40.941
29	731.5	22 26 03.183	03.669	.486	413.0	30 01 29 45.512	45.032
30	732.5	22 29 59.743	60.225	.482	414.0	31 01 25 49.598	49.122
Sept. 31	733.5	22 33 56.303	56.780	-0.477	415.0	Sept. 1 01 21 53.684	53.213
1	734.5	22 37 52.863	53.335	.473	416.0	2 01 17 57.771	57.303
2	735.5	22 41 49.422	49.891	.469	417.0	3 01 14 01.861	01.394
3	736.5	22 45 45.977	46.446	.469	418.0	4 01 10 05.955	05.484
4	737.5	22 49 42.530	43.002	.472	419.0	5 01 06 10.052	09.575
5	738.5	22 53 39.079	39.557	-0.478	420.0	6 01 02 14.150	13.665
6	739.5	22 57 35.627	36.112	.485	421.0	7 00 58 18.248	17.756
7	740.5	23 01 32.175	32.668	.493	422.0	8 00 54 22.344	21.846
8	741.5	23 05 28.725	29.223	.498	423.0	9 00 50 26.436	25.937
9	742.5	23 09 25.278	25.778	.500	424.0	10 00 46 30.525	30.027
10	743.5	23 13 21.835	22.334	-0.499	425.0	11 00 42 34.611	34.118
11	744.5	23 17 18.394	18.889	.495	426.0	12 00 38 38.696	38.208
12	745.5	23 21 14.955	15.444	.489	427.0	13 00 34 42.782	42.299
13	746.5	23 25 11.515	12.000	.484	428.0	14 00 30 46.869	46.390
14	747.5	23 29 08.075	08.555	.481	429.0	15 00 26 50.959	50.480
15	748.5	23 33 04.631	05.111	-0.480	430.0	16 00 22 55.051	54.571
16	749.5	23 37 01.184	01.666	.482	431.0	17 00 18 59.146	58.661
17	750.5	23 40 57.735	58.221	.486	432.0	18 00 15 03.243	02.752
18	751.5	23 44 54.284	54.777	.493	433.0	19 00 11 07.342	06.842
19	752.5	23 48 50.831	51.332	.501	434.0	20 00 07 11.441	10.933
20	753.5	23 52 47.378	47.887	-0.509	435.0	21 00 03 15.539	15.023
21	754.5	23 56 43.926	44.443	.517	436.0	21 23 59 19.636	19.114
22	755.5	0 00 40.475	40.998	.523	437.0	22 23 55 23.730	23.204
23	756.5	0 04 37.026	37.553	.527	438.0	23 23 51 27.823	27.295
24	757.5	0 08 33.580	34.109	.529	439.0	24 23 47 31.913	31.385
25	758.5	0 12 30.136	30.664	-0.529	440.0	25 23 43 36.001	35.476
26	759.5	0 16 26.693	27.220	.526	441.0	26 23 39 40.088	39.567
27	760.5	0 20 23.252	23.775	.523	442.0	27 23 35 44.175	43.657
28	761.5	0 24 19.811	20.330	.519	443.0	28 23 31 48.262	47.748
29	762.5	0 28 16.370	16.886	.516	444.0	29 23 27 52.352	51.838
30	763.5	0 32 12.926	13.441	-0.515	445.0	30 23 23 56.444	55.929
Oct. 1	764.5	0 36 09.479	09.996	.517	446.0	Oct. 1 23 20 00.540	00.019
2	765.5	0 40 06.029	06.552	-0.522	447.0	2 23 16 04.638	04.110

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries		
		Apparent	Mean			Apparent	Mean	
		^h ^m ^s	^s	^s		^d ^h ^m ^s	^s	
Oct.	1	2439 764.5	0 36 09.479	09.996	-0.517 446.0	Oct.	1 23 20 00.540	00.019
	2	765.5	0 40 06.029	06.552	.522 447.0		2 23 16 04.638	04.110
	3	766.5	0 44 02.577	03.107	.530 448.0		3 23 12 08.737	08.200
	4	767.5	0 47 59.124	59.662	.538 449.0		4 23 08 12.834	12.291
	5	768.5	0 51 55.673	56.218	.545 450.0		5 23 04 16.928	16.381
	6	769.5	0 55 52.225	52.773	-0.548 451.0		6 23 00 21.018	20.472
	7	770.5	0 59 48.781	49.329	.548 452.0		7 22 56 25.105	24.562
	8	771.5	1 03 45.340	45.884	.544 453.0		8 22 52 29.189	28.653
	9	772.5	1 07 41.902	42.439	.538 454.0		9 22 48 33.274	32.743
	10	773.5	1 11 38.463	38.995	.532 455.0		10 22 44 37.360	36.834
	11	774.5	1 15 35.023	35.550	-0.527 456.0		11 22 40 41.448	40.925
	12	775.5	1 19 31.581	32.105	.525 457.0		12 22 36 45.539	45.015
	13	776.5	1 23 28.135	28.661	.525 458.0		13 22 32 49.633	49.106
	14	777.5	1 27 24.687	25.216	.529 459.0		14 22 28 53.729	53.196
	15	778.5	1 31 21.237	21.771	.535 460.0		15 22 24 57.826	57.287
	16	779.5	1 35 17.785	18.327	-0.542 461.0		16 22 21 01.925	01.377
	17	780.5	1 39 14.333	14.882	.549 462.0		17 22 17 06.022	05.468
	18	781.5	1 43 10.881	11.438	.556 463.0		18 22 13 10.119	09.558
	19	782.5	1 47 07.431	07.993	.562 464.0		19 22 09 14.213	13.649
	20	783.5	1 51 03.982	04.548	.566 465.0		20 22 05 18.305	17.739
	21	784.5	1 55 00.536	01.104	-0.567 466.0		21 22 01 22.395	21.830
	22	785.5	1 58 57.093	57.659	.566 467.0		22 21 57 26.483	25.920
	23	786.5	2 02 53.651	54.214	.563 468.0		23 21 53 30.569	30.011
	24	787.5	2 06 50.211	50.770	.559 469.0		24 21 49 34.654	34.101
	25	788.5	2 10 46.771	47.325	.554 470.0		25 21 45 38.740	38.192
	26	789.5	2 14 43.331	43.880	-0.550 471.0		26 21 41 42.828	42.283
	27	790.5	2 18 39.889	40.436	.547 472.0		27 21 37 46.918	46.373
	28	791.5	2 22 36.445	36.991	.546 473.0		28 21 33 51.011	50.464
	29	792.5	2 26 32.998	33.547	.549 474.0		29 21 29 55.106	54.554
	30	793.5	2 30 29.548	30.102	.554 475.0		30 21 25 59.203	58.645
Nov.	31	794.5	2 34 26.097	26.657	-0.560 476.0	Nov.	31 21 22 03.299	02.735
	1	795.5	2 38 22.646	23.213	.566 477.0		1 21 18 07.393	06.826
	2	796.5	2 42 19.199	19.768	.569 478.0		2 21 14 11.483	10.916
	3	797.5	2 46 15.755	16.323	.568 479.0		3 21 10 15.569	15.007
	4	798.5	2 50 12.315	12.879	.563 480.0		4 21 06 19.652	19.097
	5	799.5	2 54 08.879	09.434	-0.555 481.0		5 21 02 23.734	23.188
	6	800.5	2 58 05.443	05.990	.546 482.0		6 20 58 27.816	27.278
	7	801.5	3 02 02.007	02.545	.538 483.0		7 20 54 31.900	31.369
	8	802.5	3 05 58.568	59.100	.532 484.0		8 20 50 35.988	35.459
	9	803.5	3 09 55.126	55.656	.530 485.0		9 20 46 40.079	39.550
	10	804.5	3 13 51.681	52.211	-0.530 486.0		10 20 42 44.172	43.641
	11	805.5	3 17 48.233	48.766	.533 487.0		11 20 38 48.266	47.731
	12	806.5	3 21 44.784	45.322	.538 488.0		12 20 34 52.362	51.822
	13	807.5	3 25 41.334	41.877	.543 489.0		13 20 30 56.458	55.912
	14	808.5	3 29 37.885	38.432	.548 490.0		14 20 27 00.552	00.003
	15	809.5	3 33 34.436	34.988	-0.551 491.0		15 20 23 04.645	04.093
16	810.5	3 37 30.990	31.543	-0.553 492.0	16 20 19 08.735	08.184		

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries	
		Apparent	Mean			Apparent	Mean
	2439				2446		
Nov. 16	810.5	^h ^m ^s 3 37 30.990	^s 31.543	^s -0.553	492.0	Nov. ^d ^h ^m ^s 16 20 19 08.735	^s 08.184
17	811.5	3 41 27.546	28.099	.552	493.0	17 20 15 12.823	12.274
18	812.5	3 45 24.104	24.654	.549	494.0	18 20 11 16.908	16.365
19	813.5	3 49 20.665	21.209	.544	495.0	19 20 07 20.993	20.455
20	814.5	3 53 17.227	17.765	.538	496.0	20 20 03 25.076	24.546
21	815.5	3 57 13.790	14.320	-0.530	497.0	21 19 59 29.159	28.636
22	816.5	4 01 10.352	10.875	.523	498.0	22 19 55 33.244	32.727
23	817.5	4 05 06.913	07.431	.518	499.0	23 19 51 37.331	36.818
24	818.5	4 09 03.472	03.986	.514	500.0	24 19 47 41.420	40.908
25	819.5	4 13 00.028	00.541	.514	501.0	25 19 43 45.512	44.999
26	820.5	4 16 56.581	57.097	-0.516	502.0	26 19 39 49.606	49.089
27	821.5	4 20 53.133	53.652	.519	503.0	27 19 35 53.701	53.180
28	822.5	4 24 49.685	50.208	.523	504.0	28 19 31 57.794	57.270
29	823.5	4 28 46.238	46.763	.525	505.0	29 19 28 01.883	01.361
30	824.5	4 32 42.795	43.318	.524	506.0	30 19 24 05.969	05.451
Dec. 1	825.5	4 36 39.356	39.874	-0.518	507.0	Dec. 1 19 20 10.051	09.542
2	826.5	4 40 35.921	36.429	.508	508.0	2 19 16 14.130	13.632
3	827.5	4 44 32.488	32.984	.497	509.0	3 19 12 18.209	17.723
4	828.5	4 48 29.054	29.540	.485	510.0	4 19 08 22.289	21.813
5	829.5	4 52 25.619	26.095	.476	511.0	5 19 04 26.373	25.904
6	830.5	4 56 22.181	22.650	-0.469	512.0	6 19 00 30.460	29.994
7	831.5	5 00 18.740	19.206	.466	513.0	7 18 56 34.549	34.085
8	832.5	5 04 15.296	15.761	.466	514.0	8 18 52 38.641	38.176
9	833.5	5 08 11.849	12.317	.468	515.0	9 18 48 42.735	42.266
10	834.5	5 12 08.401	08.872	.470	516.0	10 18 44 46.828	46.357
11	835.5	5 16 04.954	05.427	-0.473	517.0	11 18 40 50.921	50.447
12	836.5	5 20 01.507	01.983	.475	518.0	12 18 36 55.012	54.538
13	837.5	5 23 58.062	58.538	.476	519.0	13 18 32 59.101	58.628
14	838.5	5 27 54.619	55.093	.474	520.0	14 18 29 03.188	02.719
15	839.5	5 31 51.179	51.649	.470	521.0	15 18 25 07.273	06.809
16	840.5	5 35 47.741	48.204	-0.463	522.0	16 18 21 11.356	10.900
17	841.5	5 39 44.304	44.759	.455	523.0	17 18 17 15.437	14.990
18	842.5	5 43 40.869	41.315	.446	524.0	18 18 13 19.519	19.081
19	843.5	5 47 37.433	37.870	.437	525.0	19 18 09 23.602	23.171
20	844.5	5 51 33.996	34.426	.430	526.0	20 18 05 27.686	27.262
21	845.5	5 55 30.556	30.981	-0.424	527.0	21 18 01 31.774	31.352
22	846.5	5 59 27.114	27.536	.422	528.0	22 17 57 35.864	35.443
23	847.5	6 03 23.670	24.092	.422	529.0	23 17 53 39.956	39.534
24	848.5	6 07 20.223	20.647	.424	530.0	24 17 49 44.049	43.624
25	849.5	6 11 16.775	17.202	.427	531.0	25 17 45 48.142	47.715
26	850.5	6 15 13.329	13.758	-0.429	532.0	26 17 41 52.232	51.805
27	851.5	6 19 09.885	10.313	.428	533.0	27 17 37 56.319	55.896
28	852.5	6 23 06.445	06.868	.423	534.0	28 17 33 60.403	59.986
29	853.5	6 27 03.009	03.424	.415	535.0	29 17 30 04.482	04.077
30	854.5	6 30 59.575	59.979	.404	536.0	30 17 26 08.561	08.167
31	855.5	6 34 56.143	56.535	-0.392	537.0	31 17 22 12.640	12.258
32	856.5	6 38 52.710	53.090	-0.380	538.0	32 17 18 16.721	16.348

SUN, 1967
FOR 0^h EPHEMERIS TIME

Date	Longitude		Redn. to App. Long.	Latitude			Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic
	Mean Equinox of 1967-0			Ecliptic of						
				1967-0	1950-0	Date				
Jan.	0	278° 51' 31.7 ^{3668.2}	-32.0	+0.33	+8.09	+0.34	8.95	- 0.143	-11.033	43.040
	1	279 52 39.9 ^{3668.5}	31.8	.31	8.03	.31	8.95	- 0.006	11.006	43.102
	2	280 53 48.4 ^{3668.9}	31.7	.25	7.93	.25	8.95	+ 0.132	11.028	43.149
	3	281 54 57.3 ^{3669.2}	31.6	.16	7.80	.16	8.95	0.270	11.075	43.173
	4	282 56 06.5 ^{3669.5}	31.5	+ .05	7.64	+ .04	8.95	0.407	11.121	43.174
	5	283 57 16.0 ^{3669.8}	-31.4	-0.08	+7.47	-0.09	8.95	+ 0.545	-11.138	43.152
	6	284 58 25.8 ^{3670.0}	31.2	.22	7.28	.22	8.95	0.683	11.110	43.118
	7	285 59 35.8 ^{3670.0}	31.0	.35	7.10	.36	8.95	0.820	11.029	43.084
	8	287 00 45.8 ^{3670.0}	30.8	.47	6.93	.48	8.95	0.958	10.904	43.060
	9	288 01 55.8 ^{3670.0}	30.5	.58	6.76	.59	8.95	1.096	10.753	43.054
	10	289 03 05.8 ^{3669.7}	-30.2	-0.67	+6.62	-0.68	8.95	+ 1.233	-10.598	43.071
	11	290 04 15.5 ^{3669.4}	29.9	.73	6.50	.74	8.95	1.371	10.462	43.108
	12	291 05 24.9 ^{3669.0}	29.7	.76	6.40	.77	8.95	1.508	10.361	43.160
	13	292 06 33.9 ^{3668.6}	29.5	.76	6.33	.78	8.95	1.646	10.304	43.219
	14	293 07 42.5 ^{3668.0}	29.3	.74	6.29	.75	8.95	1.784	10.293	43.279
	15	294 08 50.5 ^{3667.3}	-29.2	-0.69	+6.27	-0.70	8.95	+ 1.921	-10.318	43.330
	16	295 09 57.8 ^{3666.6}	29.1	.61	6.28	.63	8.95	2.059	10.369	43.369
	17	296 11 04.4 ^{3665.9}	29.0	.52	6.30	.54	8.95	2.197	10.432	43.392
	18	297 12 10.3 ^{3665.1}	29.0	.41	6.33	.43	8.94	2.334	10.492	43.399
	19	298 13 15.4 ^{3664.2}	28.9	.29	6.37	.31	8.94	2.472	10.533	43.390
	20	299 14 19.6 ^{3663.4}	-28.7	-0.16	+6.42	-0.18	8.94	+ 2.610	-10.543	43.374
	21	300 15 23.0 ^{3662.4}	28.6	- .04	6.47	- .06	8.94	2.747	10.514	43.351
	22	301 16 25.4 ^{3661.5}	28.4	+ .09	6.50	+ .06	8.94	2.885	10.440	43.333
	23	302 17 26.9 ^{3660.6}	28.1	.19	6.52	.17	8.94	3.022	10.326	43.326
	24	303 18 27.5 ^{3659.7}	27.8	.29	6.53	.26	8.94	3.160	10.185	43.337
	25	304 19 27.2 ^{3658.7}	-27.5	+0.35	+6.51	+0.33	8.94	+ 3.298	-10.038	43.373
	26	305 20 25.9 ^{3657.9}	27.3	.39	6.45	.37	8.94	3.435	9.913	43.431
	27	306 21 23.8 ^{3657.2}	27.1	.40	6.37	.37	8.94	3.573	9.834	43.506
	28	307 22 21.0 ^{3656.3}	26.9	.38	6.25	.35	8.94	3.711	9.814	43.584
	29	308 23 17.3 ^{3655.6}	26.8	.32	6.10	.29	8.93	3.848	9.853	43.652
	30	309 24 12.9 ^{3654.9}	-26.7	+0.24	+5.92	+0.21	8.93	+ 3.986	- 9.928	43.695
Feb.	31	310 25 07.8 ^{3654.2}	26.7	.13	5.71	+ .11	8.93	4.124	10.011	43.712
	1	311 26 02.0 ^{3653.4}	26.6	+ .01	5.49	- .02	8.93	4.261	10.070	43.705
	2	312 26 55.4 ^{3652.7}	26.5	- .12	5.25	.15	8.93	4.399	10.086	43.683
	3	313 27 48.1 ^{3651.9}	26.3	.25	5.02	.27	8.93	4.537	10.053	43.656
	4	314 28 40.0 ^{3651.1}	-26.1	-0.37	+4.79	-0.40	8.93	+ 4.674	- 9.976	43.637
	5	315 29 31.1 ^{3650.1}	25.8	.47	4.57	.50	8.93	4.812	9.870	43.635
	6	316 30 21.2 ^{3650.1}	25.6	.56	4.38	.59	8.92	4.949	9.757	43.653
	7	317 31 10.3 ^{3649.1}	25.3	.62	4.20	.65	8.92	5.087	9.656	43.691
	8	318 31 58.3 ^{3648.0}	25.1	.65	4.06	.68	8.92	5.225	9.588	43.746
	9	319 32 45.2 ^{3645.6}	-24.9	-0.66	+3.94	-0.69	8.92	+ 5.362	- 9.558	43.810
	10	320 33 30.8 ^{3644.2}	24.8	.64	3.84	.66	8.92	5.500	9.575	43.874
	11	321 34 15.0 ^{3642.8}	24.7	.59	3.77	.62	8.92	5.638	9.633	43.933
	12	322 34 57.8 ^{3641.3}	24.7	.51	3.73	.54	8.91	5.775	9.719	43.980
	13	323 35 39.1 ^{3639.8}	24.6	.42	3.70	.45	8.91	5.913	9.824	44.010
	14	324 36 18.9 ^{3638.1}	-24.6	-0.31	+3.69	-0.34	8.91	+ 6.051	- 9.927	44.024
	15	325 36 57.0	-24.6	-0.19	+3.68	-0.22	8.91	+ 6.188	-10.018	44.024

To obtain the longitude referred to the mean equinox of 1950-0, subtract 14' 14".6.

SUN, 1967
FOR 0^h EPHEMERIS TIME

19

Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Ephemeris Transit
	^h ^m ^s	[°] ['] ["]		['] ["]	^h ^m ^s
Jan. 0	18 38 31.68 ^s 265.24	-23 08 58.9 ["] + 258.0	0.983 3024 - 104	16 17.50	12 02 52.95 ^s + 28.57
1	18 42 56.92 ^s 264.97	23 04 40.9 ["] 285.6	.983 2920 - 43	16 17.51	12 03 21.52 ^s 28.27
2	18 47 21.89 ^s 264.66	22 59 55.3 ["] 313.2	.983 2877 + 13	16 17.52	12 03 49.79 ^s 27.96
3	18 51 46.55 ^s 264.34	22 54 42.1 ["] 340.5	.983 2890 68	16 17.52	12 04 17.75 ^s 27.62
4	18 56 10.89 ^s 263.98	22 49 01.6 ["] 367.8	.983 2958 117	16 17.51	12 04 45.37 ^s 27.24
5	19 00 34.87 ^s 263.59	-22 42 53.8 ["] + 394.9	0.983 3075 + 162	16 17.50	12 05 12.61 ^s + 26.83
6	19 04 58.46 ^s 263.17	22 36 18.9 ["] 421.8	.983 3237 206	16 17.48	12 05 39.44 ^s 26.39
7	19 09 21.63 ^s 262.72	22 29 17.1 ["] 448.4	.983 3443 249	16 17.46	12 06 05.83 ^s 25.93
8	19 13 44.35 ^s 262.24	22 21 48.7 ["] 474.9	.983 3692 287	16 17.44	12 06 31.76 ^s 25.43
9	19 18 06.59 ^s 261.73	22 13 53.8 ["] 501.1	.983 3979 324	16 17.41	12 06 57.19 ^s 24.90
10	19 22 28.32 ^s 261.18	-22 05 32.7 ["] + 527.0	0.983 4303 + 363	16 17.37	12 07 22.09 ^s + 24.34
11	19 26 49.50 ^s 260.61	21 56 45.7 ["] 552.7	.983 4666 400	16 17.34	12 07 46.43 ^s 23.75
12	19 31 10.11 ^s 260.01	21 47 33.0 ["] 578.2	.983 5066 437	16 17.30	12 08 10.18 ^s 23.15
13	19 35 30.12 ^s 259.37	21 37 54.8 ["] 603.4	.983 5503 477	16 17.26	12 08 33.33 ^s 22.50
14	19 39 49.49 ^s 258.73	21 27 51.4 ["] 628.2	.983 5980 517	16 17.21	12 08 55.83 ^s 21.84
15	19 44 08.22 ^s 258.05	-21 17 23.2 ["] + 652.7	0.983 6497 + 559	16 17.16	12 09 17.67 ^s + 21.16
16	19 48 26.27 ^s 257.37	21 06 30.5 ["] 677.0	.983 7056 602	16 17.10	12 09 38.83 ^s 20.46
17	19 52 43.64 ^s 256.65	20 55 13.5 ["] 700.9	.983 7658 649	16 17.04	12 09 59.29 ^s 19.74
18	19 57 00.29 ^s 255.93	20 43 32.6 ["] 724.5	.983 8307 695	16 16.98	12 10 19.03 ^s 19.00
19	20 01 16.22 ^s 255.19	20 31 28.1 ["] 747.8	.983 9002 745	16 16.91	12 10 38.03 ^s 18.26
20	20 05 31.41 ^s 254.44	-20 19 00.3 ["] + 770.6	0.983 9747 + 797	16 16.83	12 10 56.29 ^s + 17.49
21	20 09 45.85 ^s 253.66	20 06 09.7 ["] 793.1	.984 0544 851	16 16.75	12 11 13.78 ^s 16.72
22	20 13 59.51 ^s 252.90	19 52 56.6 ["] 815.4	.984 1395 907	16 16.67	12 11 30.50 ^s 15.94
23	20 18 12.41 ^s 252.11	19 39 21.2 ["] 837.1	.984 2302 965	16 16.58	12 11 46.44 ^s 15.14
24	20 22 24.52 ^s 251.32	19 25 24.1 ["] 858.5	.984 3267 1025	16 16.48	12 12 01.58 ^s 14.36
25	20 26 35.84 ^s 250.52	-19 11 05.6 ["] + 879.7	0.984 4292 + 1087	16 16.38	12 12 15.94 ^s + 13.55
26	20 30 46.36 ^s 249.72	18 56 25.9 ["] 900.2	.984 5379 1150	16 16.28	12 12 29.49 ^s 12.76
27	20 34 56.08 ^s 248.91	18 41 25.7 ["] 920.7	.984 6529 1211	16 16.16	12 12 42.25 ^s 11.95
28	20 39 04.99 ^s 248.12	18 26 05.0 ["] 940.6	.984 7740 1271	16 16.04	12 12 54.20 ^s 11.16
29	20 43 13.11 ^s 247.31	18 10 24.4 ["] 960.2	.984 9011 1330	16 15.92	12 13 05.36 ^s 10.35
30	20 47 20.42 ^s 246.51	-17 54 24.2 ["] + 979.5	0.985 0341 + 1385	16 15.78	12 13 15.71 ^s + 9.56
31	20 51 26.93 ^s 245.72	17 38 04.7 ["] 998.4	.985 1726 1436	16 15.65	12 13 25.27 ^s 8.76
Feb. 1	20 55 32.65 ^s 244.92	17 21 26.3 ["] 1016.9	.985 3162 1484	16 15.50	12 13 34.03 ^s 7.96
2	20 59 37.57 ^s 244.13	17 04 29.4 ["] 1035.0	.985 4646 1528	16 15.36	12 13 41.99 ^s 7.17
3	21 03 41.70 ^s 243.33	16 47 14.4 ["] 1052.7	.985 6174 1569	16 15.21	12 13 49.16 ^s 6.36
4	21 07 45.03 ^s 242.54	-16 29 41.7 ["] + 1070.0	0.985 7743 + 1605	16 15.05	12 13 55.52 ^s + 5.57
5	21 11 47.57 ^s 241.74	16 11 51.7 ["] 1086.9	.985 9348 1640	16 14.89	12 14 01.09 ^s 4.77
6	21 15 49.31 ^s 240.94	15 53 44.8 ["] 1103.3	.986 0988 1671	16 14.73	12 14 05.86 ^s 3.98
7	21 19 50.25 ^s 240.15	15 35 21.5 ["] 1119.3	.986 2659 1702	16 14.56	12 14 09.84 ^s 3.18
8	21 23 50.40 ^s 239.35	15 16 42.2 ["] 1134.9	.986 4361 1730	16 14.40	12 14 13.02 ^s 2.39
9	21 27 49.75 ^s 238.55	-14 57 47.3 ["] + 1150.1	0.986 6091 + 1757	16 14.23	12 14 15.41 ^s + 1.60
10	21 31 48.30 ^s 237.77	14 38 37.2 ["] 1164.7	.986 7848 1786	16 14.05	12 14 17.01 ^s 0.81
11	21 35 46.07 ^s 236.98	14 19 12.5 ["] 1179.1	.986 9634 1812	16 13.88	12 14 17.82 ^s + 0.04
12	21 39 43.05 ^s 236.21	13 59 33.4 ["] 1193.0	.987 1446 1841	16 13.70	12 14 17.86 ^s - 0.74
13	21 43 39.26 ^s 235.43	13 39 40.4 ["] 1206.4	.987 3287 1870	16 13.52	12 14 17.12 ^s 1.50
14	21 47 34.69 ^s 234.68	-13 19 34.0 ["] + 1219.3	0.987 5157 + 1899	16 13.33	12 14 15.62 ^s - 2.25
15	21 51 29.37 ^s	-12 59 14.7 ["]	0.987 7056	16 13.14	12 14 13.37 ^s

SUN, 1967
FOR 0^h EPHEMERIS TIME

Date	Longitude Mean Equinox of 1967.0	Redn to App. Long.	Latitude Ecliptic of			Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic
			1967.0	1950.0	Date				
									23° 26'
Feb. 15	325 36 57.0	-24.6	-0.19	+3.68	-0.22	8.91	+ 6.188	-10.018	44.024
16	326 37 33.5	24.5	-0.07	3.69	-0.09	8.91	6.326	10.082	44.011
17	327 38 08.2	24.4	+0.06	3.69	+0.03	8.91	6.463	10.110	43.990
18	328 38 41.1	24.2	.18	3.68	.16	8.90	6.601	10.098	43.970
19	329 39 12.3	24.0	.29	3.67	.26	8.90	6.739	10.046	43.958
20	330 39 41.6	-23.8	+0.38	+3.63	+0.36	8.90	+ 6.876	- 9.961	43.959
21	331 40 09.0	23.5	.45	3.57	.43	8.90	7.014	9.860	43.983
22	332 40 34.7	23.3	.50	3.49	.47	8.90	7.152	9.766	44.030
23	333 40 58.5	23.1	.51	3.37	.49	8.89	7.289	9.706	44.097
24	334 41 20.5	23.0	.49	3.21	.47	8.89	7.427	9.700	44.171
25	335 41 40.8	-22.9	+0.44	+3.03	+0.42	8.89	+ 7.565	- 9.756	44.242
26	336 41 59.5	22.8	.36	2.82	.34	8.89	7.702	9.860	44.292
27	337 42 16.6	22.8	.25	2.58	.23	8.89	7.840	9.985	44.313
28	338 42 32.1	22.8	+ .13	2.33	+ .11	8.88	7.977	10.094	44.306
Mar. 1	339 42 46.1	22.7	.00	2.06	- .02	8.88	8.115	10.161	44.277
2	340 42 58.6	-22.6	-0.14	+1.79	-0.15	8.88	+ 8.253	-10.176	44.241
3	341 43 09.6	22.4	.26	1.53	.28	8.88	8.390	10.140	44.209
4	342 43 19.1	22.2	.38	1.27	.39	8.88	8.528	10.070	44.194
5	343 43 27.1	22.0	.47	1.04	.48	8.87	8.666	9.990	44.198
6	344 43 33.6	21.7	.54	0.84	.55	8.87	8.803	9.921	44.223
7	345 43 38.4	-21.6	-0.58	+0.66	-0.59	8.87	+ 8.941	- 9.879	44.263
8	346 43 41.6	21.4	.59	0.51	.60	8.87	9.079	9.875	44.314
9	347 43 43.0	21.3	.57	0.39	.58	8.86	9.216	9.914	44.369
10	348 43 42.6	21.3	.52	0.30	.53	8.86	9.354	9.995	44.418
11	349 43 40.4	21.2	.45	0.23	.46	8.86	9.491	10.107	44.456
12	350 43 36.3	-21.2	-0.36	+0.18	-0.36	8.86	+ 9.629	-10.239	44.479
13	351 43 30.2	21.2	.25	0.15	.26	8.85	9.767	10.374	44.485
14	352 43 22.1	21.2	- .13	0.13	.13	8.85	9.904	10.498	44.473
15	353 43 11.9	21.1	.00	0.12	- .01	8.85	10.042	10.597	44.449
16	354 42 59.5	21.1	+ .13	0.11	+ .13	8.85	10.180	10.664	44.416
17	355 42 45.0	-20.9	+0.25	+0.09	+0.25	8.84	+10.317	-10.689	44.380
18	356 42 28.2	20.8	.36	0.07	.37	8.84	10.455	10.676	44.351
19	357 42 09.2	20.6	.46	+0.03	.47	8.84	10.593	10.629	44.333
20	358 41 47.9	20.4	.54	-0.03	.54	8.84	10.730	10.560	44.333
21	359 41 24.3	20.2	.59	0.12	.59	8.83	10.868	10.489	44.353
22	0 40 58.4	-20.0	+0.60	-0.25	+0.61	8.83	+11.006	-10.437	44.395
23	1 40 30.2	19.8	.59	0.40	.60	8.83	11.143	10.427	44.452
24	2 39 59.8	19.7	.54	0.58	.55	8.83	11.281	10.474	44.508
25	3 39 27.1	19.7	.46	0.80	.48	8.83	11.418	10.573	44.553
26	4 38 52.4	19.7	.36	1.04	.37	8.82	11.556	10.706	44.571
27	5 38 15.5	-19.7	+0.23	-1.30	+0.25	8.82	+11.694	-10.838	44.558
28	6 37 36.8	19.6	+ .09	1.57	+ .12	8.82	11.831	10.935	44.518
29	7 36 56.1	19.5	- .04	1.85	- .02	8.81	11.969	10.974	44.463
30	8 36 13.6	19.3	.18	2.11	.15	8.81	12.107	10.954	44.409
31	9 35 29.3	19.1	.30	2.37	.27	8.81	12.244	10.889	44.367
Apr. 1	10 34 43.3	-18.9	-0.40	-2.60	-0.37	8.81	+12.382	-10.805	44.349
2	11 33 55.5	-18.7	-0.48	-2.81	-0.45	8.80	+12.520	-10.725	44.352

To obtain the longitude referred to the mean equinox of 1950.0, subtract 14' 14".6.

SUN, 1967
FOR 0^h EPHEMERIS TIME

21

Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Ephemeris Transit
	^h ^m ^s	[°] ['] ["]			^h ^m ^s
Feb. 15	21 51 29.37 ^s	-12 59 14.7 ["]	0.987 7056	16 13.14	12 14 13.37 ^s
16	21 55 23.30 ^{233.93}	12 38 42.7 ^{+1232.0}	.987 8986 ⁺¹⁹³⁰	16 12.95	12 14 10.36 ^{-3.01}
17	21 59 16.49 ^{233.19}	12 17 58.7 ^{1244.0}	.988 0948 ¹⁹⁶²	16 12.76	12 14 06.63 ^{3.73}
18	22 03 08.96 ^{232.47}	11 57 02.9 ^{1255.8}	.988 2945 ¹⁹⁹⁷	16 12.56	12 14 02.17 ^{4.46}
19	22 07 00.71 ^{231.75}	11 35 55.8 ^{1267.1}	.988 4976 ²⁰³¹	16 12.36	12 13 57.01 ^{5.16}
	231.05	1277.9	2069		5.87
20	22 10 51.76 ^{230.36}	-11 14 37.9 ^{+1288.3}	0.988 7045 ⁺²¹¹⁰	16 12.16	12 13 51.14 ^{-6.54}
21	22 14 42.12 ^{229.70}	10 53 09.6 ^{1298.4}	.988 9155 ²¹⁵³	16 11.95	12 13 44.60 ^{7.20}
22	22 18 31.82 ^{229.04}	10 31 31.2 ^{1307.9}	.989 1308 ²¹⁹⁶	16 11.74	12 13 37.40 ^{7.84}
23	22 22 20.86 ^{228.40}	10 09 43.3 ^{1317.2}	.989 3504 ²²⁴³	16 11.53	12 13 29.56 ^{8.47}
24	22 26 09.26 ^{227.79}	9 47 46.1 ^{1326.0}	.989 5747 ²²⁸⁸	16 11.31	12 13 21.09 ^{9.06}
25	22 29 57.05 ^{227.19}	-9 25 40.1 ^{+1334.5}	0.989 8035 ⁺²³³⁵	16 11.08	12 13 12.03 ^{-9.65}
26	22 33 44.24 ^{226.62}	9 03 25.6 ^{1342.6}	.990 0370 ²³⁷⁹	16 10.85	12 13 02.38 ^{10.21}
27	22 37 30.86 ^{226.08}	8 41 03.0 ^{1350.4}	.990 2749 ²⁴²²	16 10.62	12 12 52.17 ^{10.74}
28	22 41 16.94 ^{225.55}	8 18 32.6 ^{1357.7}	.990 5171 ²⁴⁶⁰	16 10.38	12 12 41.43 ^{11.26}
Mar. 1	22 45 02.49 ^{225.04}	7 55 54.9 ^{1364.8}	.990 7631 ²⁴⁹⁵	16 10.14	12 12 30.17 ^{11.76}
2	22 48 47.53 ^{224.57}	-7 33 10.1 ^{+1371.5}	0.991 0126 ⁺²⁵²⁶	16 09.90	12 12 18.41 ^{-12.23}
3	22 52 32.10 ^{224.09}	7 10 18.6 ^{1377.7}	.991 2652 ²⁵⁵²	16 09.65	12 12 06.18 ^{12.70}
4	22 56 16.19 ^{223.64}	6 47 20.9 ^{1383.5}	.991 5204 ²⁵⁷⁷	16 09.40	12 11 53.48 ^{13.14}
5	22 59 59.83 ^{223.21}	6 24 17.4 ^{1389.0}	.991 7781 ²⁵⁹⁵	16 09.15	12 11 40.34 ^{13.56}
6	23 03 43.04 ^{222.79}	6 01 08.4 ^{1394.0}	.992 0376 ²⁶¹¹	16 08.89	12 11 26.78 ^{13.97}
7	23 07 25.83 ^{222.39}	-5 37 54.4 ^{+1398.7}	0.992 2987 ⁺²⁶²⁶	16 08.64	12 11 12.81 ^{-14.37}
8	23 11 08.22 ^{222.00}	5 14 35.7 ^{1403.0}	.992 5613 ²⁶³⁶	16 08.38	12 10 58.44 ^{14.74}
9	23 14 50.22 ^{221.63}	4 51 12.7 ^{1406.7}	.992 8249 ²⁶⁴⁵	16 08.13	12 10 43.70 ^{15.09}
10	23 18 31.85 ^{221.27}	4 27 46.0 ^{1410.2}	.993 0894 ²⁶⁵⁴	16 07.87	12 10 28.61 ^{15.45}
11	23 22 13.12 ^{220.94}	4 04 15.8 ^{1413.3}	.993 3548 ²⁶⁶¹	16 07.61	12 10 13.16 ^{15.76}
12	23 25 54.06 ^{220.63}	-3 40 42.5 ^{+1415.8}	0.993 6209 ⁺²⁶⁶⁷	16 07.35	12 09 57.40 ^{-16.08}
13	23 29 34.69 ^{220.32}	3 17 06.7 ^{1418.2}	.993 8876 ²⁶⁷⁴	16 07.09	12 09 41.32 ^{16.36}
14	23 33 15.01 ^{220.05}	2 53 28.5 ^{1420.0}	.994 1550 ²⁶⁷⁹	16 06.83	12 09 24.96 ^{16.63}
15	23 36 55.06 ^{219.79}	2 29 48.5 ^{1421.4}	.994 4229 ²⁶⁸⁷	16 06.57	12 09 08.33 ^{16.89}
16	23 40 34.85 ^{219.54}	2 06 07.1 ^{1422.6}	.994 6916 ²⁶⁹³	16 06.31	12 08 51.44 ^{17.13}
17	23 44 14.39 ^{219.32}	-1 42 24.5 ^{+1423.2}	0.994 9609 ⁺²⁷⁰²	16 06.05	12 08 34.31 ^{-17.34}
18	23 47 53.71 ^{219.11}	1 18 41.3 ^{1423.5}	.995 2311 ²⁷¹¹	16 05.79	12 08 16.97 ^{17.53}
19	23 51 32.82 ^{218.93}	0 54 57.8 ^{1423.5}	.995 5022 ²⁷²³	16 05.52	12 07 59.44 ^{17.72}
20	23 55 11.75 ^{218.76}	0 31 14.3 ^{1422.9}	.995 7745 ²⁷³⁸	16 05.26	12 07 41.72 ^{17.87}
21	23 58 50.51 ^{218.62}	-0 07 31.4 ^{1422.1}	.996 0483 ²⁷⁵²	16 04.99	12 07 23.85 ^{18.01}
22	0 02 29.13 ^{218.48}	+0 16 10.7 ^{+1421.0}	0.996 3235 ⁺²⁷⁷¹	16 04.73	12 07 05.84 ^{-18.12}
23	0 06 07.61 ^{218.38}	0 39 51.7 ^{1419.4}	.996 6006 ²⁷⁹²	16 04.46	12 06 47.72 ^{18.21}
24	0 09 45.99 ^{218.30}	1 03 31.1 ^{1417.5}	.996 8798 ²⁸¹⁴	16 04.19	12 06 29.51 ^{18.28}
25	0 13 24.29 ^{218.24}	1 27 08.6 ^{1415.3}	.997 1612 ²⁸³⁶	16 03.92	12 06 11.23 ^{18.31}
26	0 17 02.53 ^{218.22}	1 50 43.9 ^{1412.8}	.997 4448 ²⁸⁵⁹	16 03.64	12 05 52.92 ^{18.34}
27	0 20 40.75 ^{218.21}	+2 14 16.7 ^{+1410.0}	0.997 7307 ⁺²⁸⁸⁰	16 03.37	12 05 34.58 ^{-18.32}
28	0 24 18.96 ^{218.24}	2 37 46.7 ^{1406.8}	.998 0187 ²⁹⁰⁰	16 03.09	12 05 16.26 ^{18.29}
29	0 27 57.20 ^{218.29}	3 01 13.5 ^{1403.5}	.998 3087 ²⁹¹⁶	16 02.81	12 04 57.97 ^{18.24}
30	0 31 35.49 ^{218.36}	3 24 37.0 ^{1399.7}	.998 6003 ²⁹²⁷	16 02.53	12 04 39.73 ^{18.15}
31	0 35 13.85 ^{218.44}	3 47 56.7 ^{1395.6}	.998 8930 ²⁹³⁶	16 02.25	12 04 21.58 ^{18.06}
Apr. 1	0 38 52.29 ^{218.55}	+4 11 12.3 ^{+1391.1}	0.999 1866 ⁺²⁹⁴¹	16 01.96	12 04 03.52 ^{-17.94}
2	0 42 30.84	+4 34 23.4	0.999 4807	16 01.68	12 03 45.58

SUN, 1967

FOR 0^h EPHEMERIS TIME

Date	Longitude Mean Equinox of 1967.0	Redn. to App. Long.	Latitude			Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic
			1967.0	Ecliptic of 1950.0	Date				
									23° 26'
Apr.	1 10 34 43.3	—18.9	—0.40	—2.60	—0.37	8.81	+12.382	—10.805	44.349
	2 11 33 55.5 ^{3552.2}	18.7	.48	2.81	.45	8.80	12.520	10.725	44.352
	3 12 33 05.9 ^{3550.4}	18.5	.53	2.99	.49	8.80	12.657	10.672	44.372
	4 13 32 14.6 ^{3548.7}	18.3	.54	3.14	.51	8.80	12.795	10.658	44.405
	5 14 31 21.5 ^{3546.9}	18.2	.54	3.26	.50	8.80	12.932	10.685	44.442
	6 15 30 26.5 ^{3545.0}	—18.1	—0.50	—3.35	—0.45	8.79	+13.070	—10.754	44.475
	7 16 29 29.7 ^{3543.2}	18.1	.43	3.41	.38	8.79	13.208	10.856	44.499
	8 17 28 31.1 ^{3541.4}	18.1	.34	3.45	.30	8.79	13.345	10.979	44.510
	9 18 27 30.4 ^{3539.3}	18.1	.24	3.47	.19	8.79	13.483	11.108	44.503
	10 19 26 27.9 ^{3537.5}	18.0	— .12	3.48	— .06	8.78	13.621	11.230	44.479
	11 20 25 23.3 ^{3535.4}	—18.0	+0.01	—3.47	+0.07	8.78	+13.758	—11.329	44.440
	12 21 24 16.6 ^{3533.3}	17.9	.14	3.46	.20	8.78	13.896	11.392	44.392
	13 22 23 07.8 ^{3531.2}	17.8	.27	3.46	.34	8.78	14.034	11.418	44.340
	14 23 21 56.9 ^{3529.1}	17.6	.39	3.46	.46	8.77	14.171	11.403	44.291
	15 24 20 43.9 ^{3527.0}	17.4	.50	3.47	.56	8.77	14.309	11.351	44.254
	16 25 19 28.6 ^{3524.7}	—17.2	+0.58	—3.51	+0.65	8.77	+14.446	—11.277	44.234
	17 26 18 11.1 ^{3522.5}	17.0	.63	3.57	.71	8.77	14.584	11.195	44.232
	18 27 16 51.3 ^{3520.2}	16.8	.66	3.66	.73	8.76	14.722	11.125	44.251
	19 28 15 29.3 ^{3518.0}	16.6	.65	3.78	.73	8.76	14.859	11.087	44.286
	20 29 14 05.1 ^{3515.8}	16.5	.61	3.93	.69	8.76	14.997	11.096	44.328
	21 30 12 38.6 ^{3513.5}	—16.4	+0.54	—4.12	+0.63	8.76	+15.135	—11.156	44.364
	22 31 11 10.0 ^{3511.4}	16.4	.44	4.32	.53	8.76	15.272	11.258	44.380
	23 32 09 39.3 ^{3509.3}	16.3	.32	4.55	.41	8.75	15.410	11.372	44.367
	24 33 08 06.6 ^{3507.3}	16.3	.19	4.80	.28	8.75	15.548	11.463	44.325
	25 34 06 31.9 ^{3505.3}	16.2	+ .05	5.04	.14	8.75	15.685	11.505	44.261
	26 35 04 55.5 ^{3503.6}	—16.0	—0.09	—5.28	+0.01	8.75	+15.823	—11.480	44.191
	27 36 03 17.3 ^{3501.8}	15.8	.22	5.52	— .12	8.74	15.961	11.398	44.130
	28 37 01 37.5 ^{3500.2}	15.5	.33	5.73	.23	8.74	16.098	11.281	44.090
	29 37 59 56.1 ^{3498.6}	15.3	.41	5.91	.31	8.74	16.236	11.159	44.074
	30 38 58 13.2 ^{3497.1}	15.0	.47	6.06	.36	8.74	16.373	11.056	44.080
May	1 39 56 28.7 ^{3495.5}	—14.8	—0.50	—6.19	—0.39	8.73	+16.511	—10.993	44.102
	2 40 54 42.8 ^{3494.1}	14.6	.50	6.28	.38	8.73	16.649	10.973	44.128
	3 41 52 55.4 ^{3492.6}	14.5	.46	6.34	.35	8.73	16.786	10.998	44.156
	4 42 51 06.5 ^{3491.1}	14.4	.40	6.37	.28	8.73	16.924	11.060	44.176
	5 43 49 16.1 ^{3489.6}	14.4	.32	6.38	.20	8.73	17.062	11.145	44.182
	6 44 47 24.2 ^{3488.1}	—14.3	—0.22	—6.36	—0.09	8.72	+17.199	—11.241	44.172
	7 45 45 30.8 ^{3486.6}	14.3	— .10	6.33	+ .03	8.72	17.337	11.332	44.145
	8 46 43 35.9 ^{3485.1}	14.2	+ .03	6.28	.16	8.72	17.475	11.403	44.104
	9 47 41 39.4 ^{3483.5}	14.1	.16	6.23	.30	8.72	17.612	11.442	44.051
	10 48 39 41.4 ^{3482.0}	14.0	.29	6.18	.43	8.72	17.750	11.442	43.994
	11 49 37 41.7 ^{3480.3}	—13.8	+0.42	—6.14	+0.56	8.71	+17.887	—11.400	43.940
	12 50 35 40.3 ^{3478.6}	13.6	.53	6.11	.67	8.71	18.025	11.320	43.895
	13 51 33 37.4 ^{3477.1}	13.3	.61	6.09	.76	8.71	18.163	11.212	43.866
	14 52 31 32.6 ^{3475.2}	13.0	.68	6.10	.82	8.71	18.300	11.096	43.857
	15 53 29 26.2 ^{3473.6}	12.8	.71	6.14	.86	8.71	18.438	10.988	43.869
	16 54 27 18.0 ^{3471.8}	—12.6	+0.72	—6.20	+0.87	8.70	+18.576	—10.909	43.895
	17 55 25 08.1 ^{3470.1}	—12.4	+0.69	—6.30	+0.84	8.70	+18.713	—10.873	43.933

To obtain the longitude referred to the mean equinox of 1950.0, subtract 14' 14".6.

SUN, 1967
FOR 0^h EPHEMERIS TIME

23

Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Ephemeris Transit
	^h ^m ^s	[°] ['] ["]		['] ["]	^h ^m ^s
Apr. 1	0 38 52.29 ^s _{218.55}	+ 4 11 12.3 ^s _{+1391.1}	0.999 1866 ^s ₊₂₉₄₁	16 01.96 ^s	12 04 03.52 ^s ₋
2	0 42 30.84 ^s _{218.68}	4 34 23.4 ^s _{1386.3}	.999 4807 ^s ₂₉₄₀	16 01.68	12 03 45.58 ^s ₋
3	0 46 09.52 ^s _{218.82}	4 57 29.7 ^s _{1381.2}	0.999 7747 ^s ₂₉₃₇	16 01.40	12 03 27.77 ^s ₋
4	0 49 48.34 ^s _{218.98}	5 20 30.9 ^s _{1375.6}	1.000 0684 ^s ₂₉₃₁	16 01.11	12 03 10.11 ^s ₋
5	0 53 27.32 ^s _{219.16}	5 43 26.5 ^s _{1369.7}	.000 3615 ^s ₂₉₂₀	16 00.83	12 02 52.63 ^s ₋
6	0 57 06.48 ^s _{219.35}	+ 6 06 16.2 ^s _{+1363.5}	1.000 6535 ^s ₊₂₉₀₉	16 00.55	12 02 35.34 ^s ₋
7	1 00 45.83 ^s _{219.56}	6 28 59.7 ^s _{1356.9}	.000 9444 ^s ₂₈₉₅	16 00.27	12 02 18.24 ^s ₋
8	1 04 25.39 ^s _{219.78}	6 51 36.6 ^s _{1349.9}	.001 2339 ^s ₂₈₇₉	16 00.00	12 02 01.37 ^s ₋
9	1 08 05.17 ^s _{220.03}	7 14 06.5 ^s _{1342.5}	.001 5218 ^s ₂₈₆₁	15 59.72	12 01 44.73 ^s ₋
10	1 11 45.20 ^s _{220.28}	7 36 29.0 ^s _{1334.9}	.001 8079 ^s ₂₈₄₄	15 59.45	12 01 28.34 ^s ₋
11	1 15 25.48 ^s _{220.56}	+ 7 58 43.9 ^s _{+1326.9}	1.002 0923 ^s ₊₂₈₂₅	15 59.17	12 01 12.21 ^s ₋
12	1 19 06.04 ^s _{220.85}	8 20 50.8 ^s _{1318.4}	.002 3748 ^s ₂₈₀₅	15 58.90	12 00 56.36 ^s ₋
13	1 22 46.89 ^s _{221.14}	8 42 49.2 ^s _{1309.6}	.002 6553 ^s ₂₇₈₆	15 58.63	12 00 40.80 ^s ₋
14	1 26 28.03 ^s _{221.46}	9 04 38.8 ^s _{1300.6}	.002 9339 ^s ₂₇₆₇	15 58.37	12 00 25.55 ^s ₋
15	1 30 09.49 ^s _{221.78}	9 26 19.4 ^s _{1291.0}	.003 2106 ^s ₂₇₄₉	15 58.10	12 00 10.61 ^s ₋
16	1 33 51.27 ^s _{222.13}	+ 9 47 50.4 ^s _{+1281.3}	1.003 4855 ^s ₊₂₇₃₃	15 57.84	11 59 56.01 ^s ₋
17	1 37 33.40 ^s _{222.47}	10 09 11.7 ^s _{1271.0}	.003 7588 ^s ₂₇₁₉	15 57.58	11 59 41.74 ^s ₋
18	1 41 15.87 ^s _{222.84}	10 30 22.7 ^s _{1260.5}	.004 0307 ^s ₂₇₀₆	15 57.32	11 59 27.84 ^s ₋
19	1 44 58.71 ^s _{223.21}	10 51 23.2 ^s _{1249.5}	.004 3013 ^s ₂₆₉₆	15 57.06	11 59 14.31 ^s ₋
20	1 48 41.92 ^s _{223.60}	11 12 12.7 ^s _{1238.4}	.004 5709 ^s ₂₆₉₀	15 56.81	11 59 01.16 ^s ₋
21	1 52 25.52 ^s _{224.01}	+11 32 51.1 ^s _{+1226.9}	1.004 8399 ^s ₊₂₆₈₅	15 56.55	11 58 48.42 ^s ₋
22	1 56 09.53 ^s _{224.44}	11 53 18.0 ^s _{1215.1}	.005 1084 ^s ₂₆₈₁	15 56.29	11 58 36.09 ^s ₋
23	1 59 53.97 ^s _{224.88}	12 13 33.1 ^s _{1202.9}	.005 3765 ^s ₂₆₈₀	15 56.04	11 58 24.20 ^s ₋
24	2 03 38.85 ^s _{225.34}	12 33 36.0 ^s _{1190.6}	.005 6445 ^s ₂₆₇₉	15 55.79	11 58 12.76 ^s ₋
25	2 07 24.19 ^s _{225.82}	12 53 26.6 ^s _{1177.9}	.005 9124 ^s ₂₆₇₆	15 55.53	11 58 01.79 ^s ₋
26	2 11 10.01 ^s _{226.32}	+13 13 04.5 ^s _{+1164.9}	1.006 1800 ^s ₊₂₆₇₂	15 55.28	11 57 51.30 ^s ₋
27	2 14 56.33 ^s _{226.83}	13 32 29.4 ^s _{1151.7}	.006 4472 ^s ₂₆₆₆	15 55.02	11 57 41.31 ^s ₋
28	2 18 43.16 ^s _{227.34}	13 51 41.1 ^s _{1138.1}	.006 7138 ^s ₂₆₅₅	15 54.77	11 57 31.83 ^s ₋
29	2 22 30.50 ^s _{227.87}	14 10 39.2 ^s _{1124.2}	.006 9793 ^s ₂₆₄₀	15 54.52	11 57 22.87 ^s ₋
30	2 26 18.37 ^s _{228.41}	14 29 23.4 ^s _{1110.1}	.007 2433 ^s ₂₆₂₃	15 54.27	11 57 14.45 ^s ₋
May 1	2 30 06.78 ^s _{228.96}	+14 47 53.5 ^s _{+1095.4}	1.007 5056 ^s ₊₂₆₀₁	15 54.02	11 57 06.58 ^s ₋
2	2 33 55.74 ^s _{229.51}	15 06 08.9 ^s _{1080.7}	.007 7657 ^s ₂₅₇₆	15 53.77	11 56 59.25 ^s ₋
3	2 37 45.25 ^s _{230.06}	15 24 09.6 ^s _{1065.4}	.008 0233 ^s ₂₅₄₇	15 53.53	11 56 52.48 ^s ₋
4	2 41 35.31 ^s _{230.63}	15 41 55.0 ^s _{1049.9}	.008 2780 ^s ₂₅₁₈	15 53.29	11 56 46.28 ^s ₋
5	2 45 25.94 ^s _{231.20}	15 59 24.9 ^s _{1034.1}	.008 5298 ^s ₂₄₈₅	15 53.05	11 56 40.64 ^s ₋
6	2 49 17.14 ^s _{231.77}	+16 16 39.0 ^s _{+1017.9}	1.008 7783 ^s ₊₂₄₄₈	15 52.82	11 56 35.57 ^s ₋
7	2 53 08.91 ^s _{232.34}	16 33 36.9 ^s _{1001.4}	.009 0231 ^s ₂₄₁₂	15 52.58	11 56 31.08 ^s ₋
8	2 57 01.25 ^s _{232.92}	16 50 18.3 ^s _{984.6}	.009 2643 ^s ₂₃₇₂	15 52.36	11 56 27.16 ^s ₋
9	3 00 54.17 ^s _{233.50}	17 06 42.9 ^s _{967.5}	.009 5015 ^s ₂₃₃₁	15 52.13	11 56 23.81 ^s ₋
10	3 04 47.67 ^s _{234.07}	17 22 50.4 ^s _{950.0}	.009 7346 ^s ₂₂₉₀	15 51.91	11 56 21.04 ^s ₋
11	3 08 41.74 ^s _{234.65}	+17 38 40.4 ^s _{+932.3}	1.009 9636 ^s ₊₂₂₄₉	15 51.70	11 56 18.83 ^s ₋
12	3 12 36.39 ^s _{235.21}	17 54 12.7 ^s _{914.2}	.010 1885 ^s ₂₂₀₇	15 51.49	11 56 17.20 ^s ₋
13	3 16 31.60 ^s _{235.77}	18 09 26.9 ^s _{895.9}	.010 4092 ^s ₂₁₆₅	15 51.28	11 56 16.13 ^s ₋
14	3 20 27.37 ^s _{236.33}	18 24 22.8 ^s _{877.3}	.010 6257 ^s ₂₁₂₅	15 51.07	11 56 15.62 ^s ₋
15	3 24 23.70 ^s _{236.89}	18 39 00.1 ^s _{858.2}	.010 8382 ^s ₂₀₈₇	15 50.87	11 56 15.67 ^s ₋
16	3 28 20.59 ^s _{237.43}	+18 53 18.3 ^s _{+839.0}	1.011 0469 ^s ₊₂₀₅₀	15 50.68	11 56 16.26 ^s ₋
17	3 32 18.02 ^s	+19 07 17.3 ^s	1.011 2519 ^s	15 50.49	11 56 17.41 ^s ₋

SUN, 1967
FOR 0^h EPHEMERIS TIME

Date	Longitude Mean Equinox of 1967-0	Redn. to App. Long.	Latitude			Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic
			1967-0	1950-0	Date				
									23° 26'
May 17	55 25 08.1	-12.4	+0.69	-6.30	+0.84	8.70	+18.713	-10.873	43.933
18	56 22 56.4	12.3	.63	6.42	.78	8.70	18.851	10.885	43.968
19	57 20 43.0	12.2	.54	6.58	.69	8.70	18.989	10.938	43.990
20	58 18 27.9	12.1	.42	6.75	.58	8.70	19.126	11.014	43.988
21	59 16 11.2	12.0	.29	6.94	.46	8.70	19.264	11.082	43.958
	3468.3								
	3466.6								
	3464.9								
	3463.3								
	3461.7								
22	60 13 52.9	-11.9	+0.15	-7.14	+0.32	8.69	+19.401	-11.111	43.904
23	61 11 33.2	11.8	+ .01	7.33	.18	8.69	19.539	11.079	43.836
24	62 09 12.1	11.5	- .12	7.51	+ .05	8.69	19.677	10.984	43.772
25	63 06 49.8	11.2	.24	7.68	- .06	8.69	19.814	10.840	43.725
26	64 04 26.3	10.9	.33	7.82	.16	8.69	19.952	10.675	43.702
	3455.5								
	3455.4								
27	65 02 01.7	-10.6	-0.40	-7.94	-0.22	8.69	+20.090	-10.522	43.703
28	65 59 36.2	10.4	.44	8.02	.26	8.68	20.227	10.401	43.726
29	66 57 09.7	10.2	.45	8.07	.26	8.68	20.365	10.326	43.759
30	67 54 42.4	10.0	.42	8.09	.24	8.68	20.503	10.299	43.794
31	68 52 14.2	9.9	.37	8.07	.19	8.68	20.640	10.315	43.823
	3451.8								
	3451.0								
June 1	69 49 45.2	- 9.8	-0.30	-8.03	-0.11	8.68	+20.778	-10.361	43.841
2	70 47 15.4	9.7	.20	7.97	- .01	8.68	20.915	10.422	43.842
3	71 44 44.8	9.6	- .10	7.89	+ .10	8.68	21.053	10.483	43.827
4	72 42 13.5	9.5	+ .03	7.80	.22	8.67	21.191	10.528	43.798
5	73 39 41.4	9.4	.15	7.70	.35	8.67	21.328	10.547	43.756
	3447.9								
	3447.0								
6	74 37 08.4	- 9.2	+0.28	-7.60	+0.48	8.67	+21.466	-10.527	43.709
7	75 34 34.7	9.0	.40	7.50	.60	8.67	21.604	10.465	43.661
8	76 32 00.2	8.8	.51	7.41	.71	8.67	21.741	10.363	43.622
9	77 29 24.9	8.5	.61	7.33	.81	8.67	21.879	10.231	43.599
10	78 26 48.6	8.2	.68	7.28	.88	8.67	22.017	10.085	43.595
	3442.9								
11	79 24 11.5	- 8.0	+0.72	-7.25	+0.93	8.67	+22.154	- 9.944	43.613
12	80 21 33.5	7.7	.73	7.25	.94	8.67	22.292	9.831	43.648
13	81 18 54.5	7.5	.71	7.28	.92	8.67	22.430	9.760	43.695
14	82 16 14.6	7.3	.66	7.34	.87	8.66	22.567	9.738	43.742
15	83 13 33.7	7.2	.57	7.42	.79	8.66	22.705	9.761	43.779
	3439.1								
	3438.2								
16	84 10 51.9	- 7.1	+0.47	-7.54	+0.68	8.66	+22.842	- 9.811	43.795
17	85 08 09.2	7.0	.34	7.66	.56	8.66	22.980	9.864	43.786
18	86 05 25.6	6.9	.21	7.79	.42	8.66	23.118	9.889	43.753
19	87 02 41.1	6.8	+ .07	7.93	.29	8.66	23.255	9.863	43.704
20	87 59 56.0	6.5	- .07	8.05	.15	8.66	23.393	9.777	43.653
	3434.9								
	3434.2								
21	88 57 10.2	- 6.2	-0.18	-8.16	+0.04	8.66	+23.531	- 9.637	43.611
22	89 54 23.9	5.9	.28	8.25	- .06	8.66	23.668	9.464	43.593
23	90 51 37.1	5.6	.36	8.31	.13	8.66	23.806	9.288	43.600
24	91 48 50.0	5.3	.40	8.34	.18	8.66	23.944	9.137	43.628
25	92 46 02.7	5.1	.41	8.33	.19	8.66	24.081	9.029	43.674
	3432.5								
26	93 43 15.2	- 4.9	-0.40	-8.30	-0.17	8.66	+24.219	- 8.971	43.726
27	94 40 27.6	4.7	.35	8.23	.13	8.66	24.356	8.961	43.774
28	95 37 40.1	4.6	.29	8.14	- .06	8.66	24.494	8.989	43.810
29	96 34 52.5	4.5	.20	8.02	+ .03	8.66	24.632	9.037	43.833
30	97 32 05.0	4.5	- .09	7.89	.13	8.66	24.769	9.093	43.839
	3432.5								
	3432.6								
July 1	98 29 17.6	- 4.4	+0.02	-7.74	+0.25	8.66	+24.907	- 9.140	43.829
2	99 26 30.3	- 4.2	+0.15	-7.59	+0.37	8.66	+25.045	- 9.163	43.805
	3432.7								

To obtain the longitude referred to the mean equinox of 1950-0, subtract 14' 14".6.

SUN, 1967
FOR 0^h EPHEMERIS TIME

25

Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Ephemeris Transit
	^h ^m ^s	[°] ['] ["]		['] ["]	^h ^m ^s
May 17	3 32 18.02 ^s	+19 07 17.3	1.011 2519	15 50.49	11 56 17.41
18	3 36 15.99 ^{237.97}	19 20 56.7 + 819.4	.011 4536 +2017	15 50.30	11 56 19.09 + 1.68
19	3 40 14.49 ^{238.50}	19 34 16.4 799.7	.011 6522 1986	15 50.11	11 56 21.31 2.22
20	3 44 13.53 ^{239.04}	19 47 16.0 779.6	.011 8479 1957	15 49.93	11 56 24.06 2.75
21	3 48 13.10 ^{239.57}	19 59 55.3 759.3	.012 0412 1933	15 49.74	11 56 27.34 3.28
	240.10	738.7	1909		3.81
22	3 52 13.20 ^{240.63}	+20 12 14.0	1.012 2321	15 49.56	11 56 31.15
23	3 56 13.83 ^{241.15}	20 24 12.1 + 718.1	.012 4210 +1889	15 49.39	11 56 35.48 + 4.33
24	4 00 14.98 ^{241.67}	20 35 49.2 697.1	.012 6077 1867	15 49.21	11 56 40.33 4.85
25	4 04 16.65 ^{242.18}	20 47 05.2 676.0	.012 7922 1845	15 49.04	11 56 45.69 5.36
26	4 08 18.83 ^{242.68}	20 57 59.8 654.6	.012 9745 1823	15 48.87	11 56 51.56 5.87
		633.0	1799		6.37
27	4 12 21.51 ^{243.19}	+21 08 32.8	1.013 1544	15 48.70	11 56 57.93
28	4 16 24.70 ^{243.66}	21 18 44.0 + 611.2	.013 3314 +1770	15 48.53	11 57 04.79 + 6.86
29	4 20 28.36 ^{244.14}	21 28 33.2 589.2	.013 5055 1741	15 48.37	11 57 12.13 7.34
30	4 24 32.50 ^{244.60}	21 38 00.2 567.0	.013 6760 1705	15 48.21	11 57 19.95 7.82
31	4 28 37.10 ^{245.04}	21 47 04.8 544.6	.013 8429 1669	15 48.06	11 57 28.22 8.27
		521.9	1629		8.70
June 1	4 32 42.14 ^{245.47}	+21 55 46.7	1.014 0058	15 47.90	11 57 36.92
2	4 36 47.61 ^{245.89}	22 04 05.7 + 499.0	.014 1644 +1586	15 47.76	11 57 46.05 + 9.13
3	4 40 53.50 ^{246.29}	22 12 01.7 476.0	.014 3185 1541	15 47.61	11 57 55.59 9.54
4	4 44 59.79 ^{246.66}	22 19 34.6 452.9	.014 4678 1493	15 47.47	11 58 05.52 9.93
5	4 49 06.45 ^{247.03}	22 26 44.0 429.4	.014 6120 1442	15 47.34	11 58 15.81 10.29
		405.8	1391		10.64
6	4 53 13.48 ^{247.36}	+22 33 29.8	1.014 7511	15 47.21	11 58 26.45
7	4 57 20.84 ^{247.68}	22 39 52.0 + 382.2	.014 8848 +1337	15 47.08	11 58 37.42 + 10.97
8	5 01 28.52 ^{247.97}	22 45 50.3 358.3	.015 0130 1282	15 46.96	11 58 48.68 11.26
9	5 05 36.49 ^{248.24}	22 51 24.6 334.3	.015 1355 1225	15 46.85	11 59 00.23 11.55
10	5 09 44.73 ^{248.47}	22 56 34.8 310.2	.015 2522 1167	15 46.74	11 59 12.03 11.80
		286.0	1112		12.02
11	5 13 53.20 ^{248.69}	+23 01 20.8	1.015 3634	15 46.64	11 59 24.05
12	5 18 01.89 ^{248.87}	23 05 42.4 + 261.6	.015 4689 +1055	15 46.54	11 59 36.27 + 12.22
13	5 22 10.76 ^{249.04}	23 09 39.5 237.1	.015 5691 1002	15 46.44	11 59 48.67 12.40
14	5 26 19.80 ^{249.17}	23 13 12.1 212.6	.015 6639 948	15 46.36	12 00 01.22 12.55
15	5 30 28.97 ^{249.28}	23 16 20.2 188.1	.015 7538 899	15 46.27	12 00 13.90 12.68
		163.3	853		12.78
16	5 34 38.25 ^{249.37}	+23 19 03.5	1.015 8391	15 46.19	12 00 26.68
17	5 38 47.62 ^{249.44}	23 21 22.1 + 138.6	.015 9199 + 808	15 46.12	12 00 39.54 + 12.86
18	5 42 57.06 ^{249.49}	23 23 15.9 113.8	.015 9967 768	15 46.05	12 00 52.45 12.91
19	5 47 06.55 ^{249.53}	23 24 44.9 89.0	.016 0698 731	15 45.98	12 01 05.41 12.96
20	5 51 16.08 ^{249.53}	23 25 49.2 64.3	.016 1394 696	15 45.91	12 01 18.38 12.97
		39.5	662		
21	5 55 25.61 ^{249.53}	+23 26 28.7	1.016 2056	15 45.85	12 01 31.35
22	5 59 35.14 ^{249.50}	23 26 43.4 + 14.7	.016 2687 + 631	15 45.79	12 01 44.30 + 12.95
23	6 03 44.64 ^{249.45}	23 26 33.4 - 10.0	.016 3285 598	15 45.74	12 01 57.22 12.92
24	6 07 54.09 ^{249.39}	23 25 58.7 34.7	.016 3852 567	15 45.68	12 02 10.08 12.86
25	6 12 03.48 ^{249.29}	23 24 59.3 59.4	.016 4385 533	15 45.64	12 02 22.86 12.78
		84.1	497		12.68
26	6 16 12.77 ^{249.18}	+23 23 35.2	1.016 4882	15 45.59	12 02 35.54
27	6 20 21.95 ^{249.04}	23 21 46.4 - 108.8	.016 5341 + 459	15 45.55	12 02 48.10 + 12.56
28	6 24 30.99 ^{248.90}	23 19 33.0 133.4	.016 5759 418	15 45.51	12 03 00.53 12.43
29	6 28 39.89 ^{248.73}	23 16 55.0 158.0	.016 6134 375	15 45.47	12 03 12.79 12.26
30	6 32 48.62 ^{248.53}	23 13 52.5 182.5	.016 6462 328	15 45.44	12 03 24.87 12.08
		207.0	280		11.88
July 1	6 36 57.15 ^{248.32}	+23 10 25.5	1.016 6742	15 45.42	12 03 36.75
2	6 41 05.47	+23 06 34.2 - 231.3	1.016 6972 + 230	15 45.39	12 03 48.39 + 11.64

SUN, 1967
FOR 0^h EPHEMERIS TIME

Date	Longitude		Redn. to App. Long.	Latitude			Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic
	Mean Equinox of 1967.0			Ecliptic of		Date				23° 26'
				1967.0	1950.0					
July	1	98 29 17.6 3432.7	- 4.4	+0.02	-7.74	+0.25	8.66	+24.907	- 9.140	43.829
	2	99 26 30.3 3432.8	4.2	.15	7.59	.37	8.66	25.045	9.163	43.805
	3	100 23 43.1 3433.0	4.1	.27	7.43	.50	8.66	25.182	9.150	43.775
	4	101 20 56.1 3433.2	3.9	.39	7.28	.61	8.66	25.320	9.099	43.742
	5	102 18 09.3 3433.3	3.7	.49	7.13	.72	8.66	25.458	9.007	43.715
	6	103 15 22.6 3433.4	- 3.4	+0.59	-6.99	+0.81	8.66	+25.595	- 8.881	43.702
	7	104 12 36.0 3433.5	3.1	.66	6.88	.88	8.66	25.733	8.736	43.707
	8	105 09 49.5 3433.7	2.9	.70	6.79	.93	8.66	25.870	8.590	43.736
	9	106 07 03.2 3433.6	2.6	.72	6.73	.94	8.66	26.008	8.466	43.783
	10	107 04 16.8 3433.7	2.4	.70	6.69	.93	8.66	26.146	8.385	43.845
	11	108 01 30.5 3433.6	- 2.2	+0.66	-6.68	+0.88	8.66	+26.283	- 8.356	43.910
	12	108 58 44.1 3433.6	2.1	.58	6.70	.81	8.66	26.421	8.376	43.964
	13	109 55 57.7 3433.6	2.0	.48	6.75	.71	8.66	26.559	8.431	44.000
	14	110 53 11.3 3433.6	1.9	.36	6.81	.59	8.66	26.696	8.495	44.011
	15	111 50 24.9 3433.5	1.8	.23	6.88	.45	8.66	26.834	8.540	43.998
	16	112 47 38.4 3433.7	- 1.7	+0.09	-6.96	+0.32	8.66	+26.972	- 8.541	43.968
	17	113 44 52.1 3433.7	1.5	-.04	7.03	.18	8.66	27.109	8.487	43.932
	18	114 42 05.8 3433.9	1.3	.16	7.08	+.06	8.66	27.247	8.381	43.903
	19	115 39 19.7 3434.3	1.0	.26	7.12	-.04	8.66	27.385	8.238	43.890
	20	116 36 34.0 3434.5	0.7	.34	7.12	.12	8.66	27.522	8.081	43.902
	21	117 33 48.5 3435.1	- 0.4	-0.39	-7.10	-0.17	8.66	+27.660	- 7.940	43.939
	22	118 31 03.6 3435.6	- 0.2	.41	7.05	.19	8.66	27.797	7.835	43.992
	23	119 28 19.2 3436.3	0.0	.40	6.96	.18	8.66	27.935	7.778	44.056
	24	120 25 35.5 3437.0	+ 0.2	.36	6.84	.14	8.66	28.073	7.772	44.119
	25	121 22 52.5 3437.8	0.3	.29	6.70	-.08	8.66	28.210	7.810	44.173
	26	122 20 10.3 3438.7	+ 0.3	-0.21	-6.53	0.00	8.66	+28.348	- 7.875	44.213
	27	123 17 29.0 3439.6	0.4	-.10	6.35	+.10	8.67	28.486	7.954	44.237
	28	124 14 48.6 3440.6	0.4	+.01	6.15	.22	8.67	28.623	8.028	44.243
	29	125 12 09.2 3441.6	0.5	.13	5.95	.33	8.67	28.761	8.085	44.234
	30	126 09 30.8 3442.7	0.6	.25	5.74	.45	8.67	28.899	8.110	44.215
Aug.	31	127 06 53.5 3443.7	+ 0.8	+0.36	-5.53	+0.56	8.67	+29.036	- 8.099	44.193
	1	128 04 17.2 3444.8	1.0	.47	5.34	.67	8.67	29.174	8.049	44.175
	2	129 01 42.0 3445.9	1.2	.56	5.15	.76	8.67	29.311	7.962	44.166
	3	129 59 07.9 3447.0	1.4	.63	4.99	.83	8.67	29.449	7.850	44.174
	4	130 56 34.9 3448.0	1.7	.68	4.85	.87	8.67	29.587	7.730	44.203
	5	131 54 02.9 3449.1	+ 1.9	+0.69	-4.73	+0.88	8.67	+29.724	- 7.624	44.253
	6	132 51 32.0 3450.1	2.1	.68	4.65	.87	8.68	29.862	7.553	44.319
	7	133 49 02.1 3451.0	2.3	.64	4.59	.82	8.68	30.000	7.534	44.394
	8	134 46 33.1 3452.0	2.4	.57	4.56	.75	8.68	30.137	7.572	44.463
	9	135 44 05.1 3452.8	2.4	.47	4.55	.65	8.68	30.275	7.651	44.512
	10	136 41 37.9 3453.7	+ 2.5	+0.35	-4.56	+0.53	8.68	+30.413	- 7.748	44.536
	11	137 39 11.6 3454.6	2.5	.22	4.59	.39	8.68	30.550	7.832	44.533
	12	138 36 46.2 3455.3	2.6	+.09	4.62	.25	8.68	30.688	7.878	44.510
	13	139 34 21.5 3456.3	2.8	-.05	4.64	+.12	8.69	30.825	7.871	44.478
	14	140 31 57.8 3457.1	2.9	.17	4.65	-.01	8.69	30.963	7.810	44.451
	15	141 29 34.9 3458.2	+ 3.2	-0.27	-4.64	-0.12	8.69	+31.101	- 7.711	44.439
16	142 27 13.1	+ 3.4	-0.35	-4.61	-0.20	8.69	+31.238	- 7.595	44.449	

To obtain the longitude referred to the mean equinox of 1950.0, subtract 14' 14".6.

SUN, 1967
FOR 0^h EPHEMERIS TIME

27

Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Ephemeris Transit
	^h ^m ^s	[°] ['] ["]		['] ["]	^h ^m ^s
July 1	6 36 57.15 ^s	+23 10 25.5	1.016 6742	15 45.42	12 03 36.75
2	6 41 05.47 ^{248.32}	23 06 34.2 - 231.3	.016 6972 + 230	15 45.39	12 03 48.39 + 11.64
3	6 45 13.54 ^{248.07}	23 02 18.6 - 255.6	.016 7149 177	15 45.38	12 03 59.78 11.39
4	6 49 21.36 ^{247.82}	22 57 38.8 - 279.8	.016 7271 122	15 45.37	12 04 10.90 11.12
5	6 53 28.90 ^{247.54}	22 52 34.9 - 303.9	.016 7336 65	15 45.36	12 04 21.73 10.83
6	6 57 36.12 ^{247.22}	+22 47 07.2 - 327.7	.016 7343 + 7	15 45.36	12 04 32.23 10.50
7	7 01 43.02 ^{246.90}	22 41 15.6 - 351.6	.016 7289 - 54	15 45.37	12 04 42.39 + 10.16
8	7 05 49.56 ^{246.54}	22 35 00.4 - 375.2	.016 7173 116	15 45.38	12 04 52.18 9.79
9	7 09 55.72 ^{246.16}	22 28 21.7 - 398.7	.016 6996 177	15 45.39	12 05 01.58 9.40
10	7 14 01.48 ^{245.76}	22 21 19.7 - 422.0	.016 6756 240	15 45.41	12 05 10.56 8.98
11	7 18 06.81 ^{245.33}	+22 13 54.5 - 445.2	.016 6457 299	15 45.44	12 05 19.11 8.55
12	7 22 11.69 ^{244.88}	22 06 06.4 - 468.1	.016 6098 - 359	15 45.48	12 05 27.21 + 8.10
13	7 26 16.10 ^{244.41}	21 57 55.4 - 491.0	.016 5684 414	15 45.51	12 05 34.83 7.62
14	7 30 20.03 ^{243.93}	21 49 21.9 - 513.5	.016 5217 467	15 45.56	12 05 41.96 7.13
15	7 34 23.46 ^{243.43}	21 40 26.0 - 535.9	.016 4701 516	15 45.61	12 05 48.58 6.62
16	7 38 26.39 ^{242.93}	+21 31 07.9 - 558.1	.016 4139 562	15 45.66	12 05 54.69 6.11
17	7 42 28.79 ^{242.40}	21 21 27.8 - 580.1	.016 3534 - 605	15 45.71	12 06 00.26 + 5.57
18	7 46 30.66 ^{241.87}	21 11 26.1 - 601.7	.016 2890 644	15 45.77	12 06 05.30 5.04
19	7 50 32.00 ^{241.34}	21 01 02.9 - 623.2	.016 2209 681	15 45.84	12 06 09.80 4.50
20	7 54 32.78 ^{240.78}	20 50 18.4 - 644.5	.016 1494 715	15 45.90	12 06 13.74 3.94
21	7 58 33.01 ^{240.23}	+20 39 13.0 - 665.4	.016 0747 747	15 45.97	12 06 17.12 3.38
22	8 02 32.68 ^{239.67}	20 27 46.8 - 686.2	.015 9967 - 780	15 46.05	12 06 19.95 + 2.83
23	8 06 31.78 ^{239.10}	20 16 00.0 - 706.8	.015 9155 812	15 46.12	12 06 22.20 2.25
24	8 10 30.31 ^{238.53}	20 03 53.0 - 727.0	.015 8311 844	15 46.20	12 06 23.89 1.69
25	8 14 28.27 ^{237.96}	19 51 25.8 - 747.2	.015 7433 878	15 46.28	12 06 25.00 1.11
26	8 18 25.65 ^{237.38}	+19 38 38.8 - 767.0	.015 6520 913	15 46.37	12 06 25.54 + 0.54
27	8 22 22.45 ^{236.80}	19 25 32.2 - 786.6	.015 5568 - 952	15 46.46	12 06 25.50 - 0.04
28	8 26 18.67 ^{236.22}	19 12 06.2 - 806.0	.015 4578 990	15 46.55	12 06 24.88 0.62
29	8 30 14.32 ^{235.65}	18 58 21.2 - 825.0	.015 3547 1031	15 46.64	12 06 23.68 1.20
30	8 34 09.37 ^{235.05}	18 44 17.3 - 843.9	.015 2473 1074	15 46.74	12 06 21.88 1.80
31	8 38 03.84 ^{234.47}	+18 29 54.8 - 862.5	.015 1354 1119	15 46.85	12 06 19.50 2.38
Aug. 1	8 41 57.73 ^{233.89}	18 15 14.0 - 880.8	.015 0188 - 1166	15 46.96	12 06 16.53 - 2.97
2	8 45 51.03 ^{233.30}	18 00 15.3 - 898.7	.014 8973 1215	15 47.07	12 06 12.97 3.56
3	8 49 43.73 ^{232.70}	17 44 58.8 - 916.5	.014 7707 1266	15 47.19	12 06 08.81 4.16
4	8 53 35.84 ^{232.11}	17 29 25.0 - 933.8	.014 6388 1319	15 47.31	12 06 04.06 4.75
5	8 57 27.36 ^{231.52}	+17 13 34.0 - 951.0	.014 5013 1375	15 47.44	12 05 58.72 5.34
6	9 01 18.28 ^{230.92}	16 57 26.2 - 967.8	.014 3583 - 1430	15 47.57	12 05 52.77 - 5.95
7	9 05 08.59 ^{230.31}	16 41 02.0 - 984.2	.014 2097 1486	15 47.71	12 05 46.22 6.55
8	9 08 58.30 ^{229.71}	16 24 21.6 - 1000.4	.014 0555 1542	15 47.86	12 05 39.08 7.14
9	9 12 47.40 ^{229.10}	16 07 25.3 - 1016.3	.013 8958 1597	15 48.01	12 05 31.33 7.75
10	9 16 35.91 ^{228.51}	+15 50 13.5 - 1031.8	.013 7309 1649	15 48.16	12 05 22.98 8.35
11	9 20 23.82 ^{227.91}	15 32 46.5 - 1047.0	.013 5612 - 1697	15 48.32	12 05 14.05 - 8.93
12	9 24 11.14 ^{227.32}	15 15 04.7 - 1061.8	.013 3868 1744	15 48.48	12 05 04.52 9.53
13	9 27 57.87 ^{226.73}	14 57 08.3 - 1076.4	.013 2083 1785	15 48.65	12 04 54.41 10.11
14	9 31 44.04 ^{226.17}	14 38 57.6 - 1090.7	.013 0259 1824	15 48.82	12 04 43.73 10.68
15	9 35 29.63 ^{225.59}	+14 20 33.1 - 1104.5	.012 8402 1857	15 48.99	12 04 32.48 11.25
16	9 39 14.67 ^{225.04}	+14 01 55.0 - 1118.1	.012 6514 - 1888	15 49.17	12 04 20.69 - 11.79

SUN, 1967
FOR 0^h EPHEMERIS TIME

Date	Longitude Mean Equinox of 1967.0	Redn. to App. Long.	Latitude Ecliptic of			Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic
			1967.0	1950.0	Date				
									23° 26'
Aug. 16	142° 27' 13.1"	+ 3.4	-0.35	-4.61	-0.20	8.69	+31.238	- 7.595	44.449
17	143 24 52.2	3.7	.40	4.55	.25	8.69	31.376	7.487	44.479
18	144 22 32.5	3.9	.43	4.45	.28	8.69	31.514	7.410	44.531
19	145 20 14.0	4.0	.41	4.33	.27	8.70	31.651	7.378	44.594
20	146 17 56.7	4.2	.38	4.17	.24	8.70	31.789	7.394	44.659
21	147 15 40.8	+ 4.2	-0.31	-3.99	-0.18	8.70	+31.927	- 7.455	44.717
22	148 13 26.4	4.3	.23	3.78	-.09	8.70	32.064	7.550	44.763
23	149 11 13.5	4.3	.12	3.56	+ .01	8.70	32.202	7.663	44.791
24	150 09 02.1	4.3	-.01	3.32	.12	8.70	32.339	7.777	44.801
25	151 06 52.4	4.4	+ .12	3.07	.24	8.71	32.477	7.877	44.795
26	152 04 44.4	+ 4.4	+0.25	-2.82	+0.36	8.71	+32.615	- 7.950	44.777
27	153 02 38.1	4.5	.37	2.57	.48	8.71	32.752	7.987	44.752
28	154 00 33.6	4.6	.48	2.34	.59	8.71	32.890	7.986	44.729
29	154 58 30.9	4.8	.57	2.11	.68	8.71	33.028	7.949	44.713
30	155 56 30.1	5.0	.65	1.91	.75	8.71	33.165	7.883	44.711
31	156 54 31.1	+ 5.2	+0.70	-1.73	+0.80	8.72	+33.303	- 7.803	44.727
Sept. 1	157 52 34.0	5.4	.73	1.57	.82	8.72	33.441	7.726	44.764
2	158 50 38.7	5.6	.73	1.44	.81	8.72	33.578	7.673	44.819
3	159 48 45.3	5.8	.69	1.35	.77	8.72	33.716	7.665	44.887
4	160 46 53.6	5.8	.63	1.28	.71	8.73	33.854	7.713	44.953
5	161 45 03.7	+ 5.9	+0.54	-1.24	+0.61	8.73	+33.991	- 7.810	45.006
6	162 43 15.4	5.9	.43	1.22	.49	8.73	34.129	7.936	45.033
7	163 41 28.8	5.9	.30	1.22	.36	8.73	34.266	8.060	45.029
8	164 39 43.7	5.9	.16	1.22	.22	8.73	34.404	8.149	45.001
9	165 38 00.1	6.0	+ .03	1.22	+ .08	8.74	34.542	8.183	44.959
10	166 36 18.1	+ 6.2	-0.09	-1.21	-0.05	8.74	+34.679	- 8.159	44.917
11	167 34 37.5	6.4	.20	1.18	.16	8.74	34.817	8.092	44.890
12	168 32 58.5	6.6	.28	1.13	.25	8.74	34.955	8.002	44.884
13	169 31 20.9	6.8	.34	1.05	.31	8.75	35.092	7.919	44.901
14	170 29 45.0	7.0	.36	0.94	.34	8.75	35.230	7.860	44.936
15	171 28 10.7	+ 7.2	-0.35	-0.79	-0.34	8.75	+35.368	- 7.844	44.985
16	172 26 38.0	7.3	.31	0.62	.30	8.75	35.505	7.874	45.039
17	173 25 07.1	7.3	.25	0.41	.24	8.75	35.643	7.950	45.088
18	174 23 38.0	7.3	.16	-0.19	.16	8.76	35.780	8.061	45.124
19	175 22 10.8	7.3	-.05	+0.06	-.05	8.76	35.918	8.193	45.144
20	176 20 45.6	+ 7.3	+0.08	+0.32	+0.07	8.76	+36.056	- 8.329	45.146
21	177 19 22.3	7.3	.21	0.58	.19	8.76	36.193	8.455	45.129
22	178 18 01.1	7.4	.34	0.85	.32	8.77	36.331	8.555	45.100
23	179 16 42.0	7.4	.47	1.12	.44	8.77	36.469	8.623	45.063
24	180 15 25.1	7.6	.59	1.38	.56	8.77	36.606	8.652	45.025
25	181 14 10.3	+ 7.7	+0.70	+1.62	+0.66	8.77	+36.744	- 8.643	44.990
26	182 12 57.8	7.9	.79	1.85	.74	8.78	36.882	8.604	44.968
27	183 11 47.6	8.1	.85	2.05	.80	8.78	37.019	8.545	44.963
28	184 10 39.6	8.2	.89	2.22	.83	8.78	37.157	8.483	44.975
29	185 09 33.9	8.4	.90	2.36	.83	8.78	37.294	8.435	45.008
30	186 08 30.5	+ 8.6	+0.88	+2.47	+0.80	8.79	+37.432	- 8.420	45.054
Oct. 1	187 07 29.4	+ 8.7	+0.82	+2.55	+0.74	8.79	+37.570	- 8.455	45.105

To obtain the longitude referred to the mean equinox of 1950.0, subtract 14' 14".6.

SUN, 1967
FOR 0^h EPHEMERIS TIME

29

Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Ephe- meris Transit
	^h ^m ^s	[°] ['] ["]		['] ["]	^h ^m ^s
Aug. 16	9 39 14.67 ^s _{224.50}	+14 01 55.0 ["] _{-1131.4}	1.012 6514 ["] ₋₁₉₁₆	15 49.17	12 04 20.69 ^s _{-12.34}
17	9 42 59.17 ^s _{223.96}	13 43 03.6 ["] _{1144.3}	.012 4598 ["] ₁₉₄₂	15 49.35	12 04 08.35 ^s _{12.85}
18	9 46 43.13 ^s _{223.45}	13 23 59.3 ["] _{1156.9}	.012 2656 ["] ₁₉₆₄	15 49.53	12 03 55.50 ^s _{13.37}
19	9 50 26.58 ^s _{222.94}	13 04 42.4 ["] _{1169.3}	.012 0692 ["] ₁₉₈₆	15 49.72	12 03 42.13 ^s _{13.86}
20	9 54 09.52 ^s _{222.45}	12 45 13.1 ["] _{1181.4}	.011 8706 ["] ₂₀₀₉	15 49.90	12 03 28.27 ^s _{14.34}
21	9 57 51.97 ^s _{221.97}	+12 25 31.7 ["] _{-1193.2}	1.011 6697 ["] ₋₂₀₂₉	15 50.09	12 03 13.93 ^s _{-14.80}
22	10 01 33.94 ^s _{221.52}	12 05 38.5 ["] _{1204.7}	.011 4668 ["] ₂₀₅₀	15 50.28	12 02 59.13 ^s _{15.25}
23	10 05 15.46 ^s _{221.08}	11 45 33.8 ["] _{1215.9}	.011 2618 ["] ₂₀₇₄	15 50.48	12 02 43.88 ^s _{15.68}
24	10 08 56.54 ^s _{220.66}	11 25 17.9 ["] _{1226.8}	.011 0544 ["] ₂₀₉₇	15 50.67	12 02 28.20 ^s _{16.09}
25	10 12 37.20 ^s _{220.25}	11 04 51.1 ["] _{1237.4}	.010 8447 ["] ₂₁₂₂	15 50.87	12 02 12.11 ^s _{16.50}
26	10 16 17.45 ^s _{219.86}	+10 44 13.7 ["] _{-1247.8}	1.010 6325 ["] ₋₂₁₄₉	15 51.07	12 01 55.61 ^s _{-16.88}
27	10 19 57.31 ^s _{219.49}	10 23 25.9 ["] _{1257.7}	.010 4176 ["] ₂₁₇₇	15 51.27	12 01 38.73 ^s _{17.25}
28	10 23 36.80 ^s _{219.12}	10 02 28.2 ["] _{1267.4}	.010 1999 ["] ₂₂₀₆	15 51.48	12 01 21.48 ^s _{17.60}
29	10 27 15.92 ^s _{218.79}	9 41 20.8 ["] _{1276.8}	.009 9793 ["] ₂₂₃₇	15 51.68	12 01 03.88 ^s _{17.94}
30	10 30 54.71 ^s _{218.45}	9 20 04.0 ["] _{1285.9}	.009 7556 ["] ₂₂₇₁	15 51.89	12 00 45.94 ^s _{18.26}
31	10 34 33.16 ^s _{218.14}	+ 8 58 38.1 ["] _{-1294.5}	1.009 5285 ["] ₋₂₃₀₅	15 52.11	12 00 27.68 ^s _{-18.57}
Sept. 1	10 38 11.30 ^s _{217.83}	8 37 03.6 ["] _{1303.0}	.009 2980 ["] ₂₃₄₃	15 52.33	12 00 09.11 ^s _{18.87}
2	10 41 49.13 ^s _{217.55}	8 15 20.6 ["] _{1310.9}	.009 0637 ["] ₂₃₈₃	15 52.55	11 59 50.24 ^s _{19.14}
3	10 45 26.68 ^s _{217.27}	7 53 29.7 ["] _{1318.7}	.008 8254 ["] ₂₄₂₃	15 52.77	11 59 31.10 ^s _{19.41}
4	10 49 03.95 ^s _{217.00}	7 31 31.0 ["] _{1326.0}	.008 5831 ["] ₂₄₆₄	15 53.00	11 59 11.69 ^s _{19.67}
5	10 52 40.95 ^s _{216.76}	+ 7 09 25.0 ["] _{-1333.1}	1.008 3367 ["] ₋₂₅₀₄	15 53.23	11 58 52.02 ^s _{-19.90}
6	10 56 17.71 ^s _{216.52}	6 47 11.9 ["] _{1339.6}	.008 0863 ["] ₂₅₄₃	15 53.47	11 58 32.12 ^s _{20.13}
7	10 59 54.23 ^s _{216.31}	6 24 52.3 ["] _{1346.0}	.007 8320 ["] ₂₅₇₉	15 53.71	11 58 11.99 ^s _{20.35}
8	11 03 30.54 ^s _{216.10}	6 02 26.3 ["] _{1351.9}	.007 5741 ["] ₂₆₁₃	15 53.95	11 57 51.64 ^s _{20.54}
9	11 07 06.64 ^s _{215.91}	5 39 54.4 ["] _{1357.5}	.007 3128 ["] ₂₆₄₁	15 54.20	11 57 31.10 ^s _{20.73}
10	11 10 42.55 ^s _{215.75}	+ 5 17 16.9 ["] _{-1362.8}	1.007 0487 ["] ₋₂₆₆₇	15 54.45	11 57 10.37 ^s _{-20.88}
11	11 14 18.30 ^s _{215.60}	4 54 34.1 ["] _{1367.6}	.006 7820 ["] ₂₆₈₈	15 54.71	11 56 49.49 ^s _{21.03}
12	11 17 53.90 ^s _{215.47}	4 31 46.5 ["] _{1372.2}	.006 5132 ["] ₂₇₀₄	15 54.96	11 56 28.46 ^s _{21.14}
13	11 21 29.37 ^s _{215.35}	4 08 54.3 ["] _{1376.4}	.006 2428 ["] ₂₇₁₈	15 55.22	11 56 07.32 ^s _{21.25}
14	11 25 04.72 ^s _{215.26}	3 45 57.9 ["] _{1380.4}	.005 9710 ["] ₂₇₂₈	15 55.47	11 55 46.07 ^s _{21.33}
15	11 28 39.98 ^s _{215.20}	+ 3 22 57.5 ["] _{-1383.9}	1.005 6982 ["] ₋₂₇₃₆	15 55.73	11 55 24.74 ^s _{-21.37}
16	11 32 15.18 ^s _{215.14}	2 59 53.6 ["] _{1387.2}	.005 4246 ["] ₂₇₄₀	15 55.99	11 55 03.37 ^s _{21.41}
17	11 35 50.32 ^s _{215.13}	2 36 46.4 ["] _{1390.2}	.005 1506 ["] ₂₇₄₅	15 56.25	11 54 41.96 ^s _{21.43}
18	11 39 25.45 ^s _{215.12}	2 13 36.2 ["] _{1392.9}	.004 8761 ["] ₂₇₄₇	15 56.52	11 54 20.53 ^s _{21.40}
19	11 43 00.57 ^s _{215.15}	1 50 23.3 ["] _{1395.2}	.004 6014 ["] ₂₇₄₉	15 56.78	11 53 59.13 ^s _{21.37}
20	11 46 35.72 ^s _{215.20}	+ 1 27 08.1 ["] _{-1397.4}	1.004 3265 ["] ₋₂₇₅₀	15 57.04	11 53 37.76 ^s _{-21.31}
21	11 50 10.92 ^s _{215.28}	1 03 50.7 ["] _{1399.0}	.004 0515 ["] ₂₇₅₂	15 57.30	11 53 16.45 ^s _{21.23}
22	11 53 46.20 ^s _{215.37}	0 40 31.7 ["] _{1400.6}	.003 7763 ["] ₂₇₅₃	15 57.56	11 52 55.22 ^s _{21.12}
23	11 57 21.57 ^s _{215.49}	+ 0 17 11.1 ["] _{1401.7}	.003 5010 ["] ₂₇₅₇	15 57.83	11 52 34.10 ^s _{20.99}
24	12 00 57.06 ^s _{215.63}	- 0 06 10.6 ["] _{1402.5}	.003 2253 ["] ₂₇₆₀	15 58.09	11 52 13.11 ^s _{20.84}
25	12 04 32.69 ^s _{215.79}	- 0 29 33.1 ["] _{-1402.9}	1.002 9493 ["] ₋₂₇₆₅	15 58.35	11 51 52.27 ^s _{-20.67}
26	12 08 08.48 ^s _{215.98}	0 52 56.0 ["] _{1403.1}	.002 6728 ["] ₂₇₇₂	15 58.62	11 51 31.60 ^s _{-20.48}
27	12 11 44.46 ^s _{216.18}	1 16 19.1 ["] _{1402.9}	.002 3956 ["] ₂₇₇₉	15 58.88	11 51 11.12 ^s _{-20.27}
28	12 15 20.64 ^s _{216.41}	1 39 42.0 ["] _{1402.4}	.002 1177 ["] ₂₇₉₁	15 59.15	11 50 50.85 ^s _{-20.03}
29	12 18 57.05 ^s _{216.65}	2 03 04.4 ["] _{1401.4}	.001 8386 ["] ₂₈₀₁	15 59.42	11 50 30.82 ^s _{-19.77}
30	12 22 33.70 ^s _{216.91}	- 2 26 25.8 ["] _{-1400.2}	1.001 5585 ["] ₋₂₈₁₆	15 59.68	11 50 11.05 ^s _{-19.50}
Oct. 1	12 26 10.61 ^s	- 2 49 46.0 ["]	1.001 2769 ["]	15 59.95	11 49 51.55 ^s

SUN, 1967
FOR 0^h EPHEMERIS TIME

Date	Longitude Mean Equinox of 1967-0	Redn. to App. Long.	Latitude Ecliptic of			Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic
			1967-0	1950-0	Date				
									23° 26'
Oct. 1	187 07 29.4	+ 8.7	+0.82	+2.55	+0.74	8.79	+37.570	- 8.455	45.105
2	188 06 30.5 ^{3541.1}	8.7	0.74	2.60	.65	8.79	37.707	8.540	45.149
3	189 05 33.7 ^{3543.2}	8.7	0.63	2.63	.54	8.79	37.845	8.664	45.173
4	190 04 39.1 ^{3545.4}	8.7	0.50	2.63	.40	8.80	37.983	8.798	45.165
5	191 03 46.5 ^{3547.4}	8.7	0.37	2.63	.26	8.80	38.120	8.908	45.128
6	192 02 55.8 ^{3549.3}	+ 8.8	+0.23	+2.63	+0.12	8.80	+38.258	- 8.963	45.071
7	193 02 07.1 ^{3551.3}	9.0	+0.10	2.63	- .01	8.80	38.396	8.954	45.008
8	194 01 20.1 ^{3553.0}	9.2	-0.01	2.65	.13	8.81	38.533	8.888	44.956
9	195 00 34.9 ^{3554.8}	9.4	0.10	2.69	.23	8.81	38.671	8.790	44.924
10	195 59 51.5 ^{3556.6}	9.6	0.17	2.75	.30	8.81	38.808	8.690	44.919
11	196 59 09.8 ^{3558.3}	+ 9.8	-0.20	+2.85	-0.34	8.81	+38.946	- 8.614	44.935
12	197 58 29.8 ^{3560.0}	10.0	0.20	2.97	.34	8.82	39.084	8.578	44.966
13	198 57 51.6 ^{3561.8}	10.1	0.17	3.13	.32	8.82	39.221	8.590	45.002
14	199 57 15.2 ^{3563.6}	10.2	0.10	3.32	.26	8.82	39.359	8.647	45.036
15	200 56 40.7 ^{3565.5}	10.2	-0.02	3.53	.18	8.82	39.497	8.740	45.059
16	201 56 08.0 ^{3567.3}	+10.2	+0.09	+3.76	-0.08	8.83	+39.634	- 8.858	45.066
17	202 55 37.2 ^{3569.2}	10.2	0.21	4.01	+ .03	8.83	39.772	8.983	45.057
18	203 55 08.4 ^{3571.2}	10.3	0.34	4.26	.16	8.83	39.910	9.098	45.030
19	204 54 41.6 ^{3573.2}	10.3	0.48	4.51	.29	8.83	40.047	9.191	44.986
20	205 54 16.8 ^{3575.2}	10.4	0.61	4.76	.41	8.84	40.185	9.252	44.935
21	206 53 54.2 ^{3577.4}	+10.5	+0.73	+5.01	+0.53	8.84	+40.323	- 9.275	44.881
22	207 53 33.6 ^{3579.4}	10.6	0.84	5.23	.64	8.84	40.460	9.257	44.830
23	208 53 15.2 ^{3581.6}	10.8	0.94	5.44	.72	8.84	40.598	9.209	44.789
24	209 52 59.0 ^{3583.8}	11.0	1.01	5.63	.79	8.85	40.735	9.137	44.764
25	210 52 45.0 ^{3586.0}	11.2	1.07	5.78	.82	8.85	40.873	9.056	44.757
26	211 52 33.2 ^{3588.2}	+11.4	+1.07	+5.91	+0.83	8.85	+41.011	- 8.985	44.768
27	212 52 23.7 ^{3590.5}	11.6	1.05	6.00	.81	8.85	41.148	8.938	44.795
28	213 52 16.5 ^{3592.8}	11.8	1.00	6.06	.76	8.86	41.286	8.933	44.830
29	214 52 11.4 ^{3594.9}	11.8	0.92	6.09	.67	8.86	41.424	8.975	44.864
30	215 52 08.6 ^{3597.2}	11.9	0.82	6.10	.56	8.86	41.561	9.057	44.881
31	216 52 07.8 ^{3599.2}	+11.9	+0.70	+6.08	+0.43	8.86	+41.699	- 9.163	44.876
Nov. 1	217 52 09.2 ^{3601.4}	12.0	0.56	6.05	.29	8.87	41.837	9.258	44.840
2	218 52 12.5 ^{3603.3}	12.0	0.42	6.01	.15	8.87	41.974	9.309	44.779
3	219 52 17.8 ^{3605.3}	12.2	0.29	5.97	+ .01	8.87	42.112	9.293	44.703
4	220 52 24.8 ^{3607.0}	12.4	0.17	5.95	- .12	8.87	42.249	9.211	44.633
5	221 52 33.6 ^{3608.8}	+12.7	+0.06	+5.94	-0.23	8.87	+42.387	- 9.080	44.580
6	222 52 43.9 ^{3610.3}	12.9	-0.01	5.96	.31	8.88	42.525	8.931	44.555
7	223 52 55.8 ^{3611.9}	13.2	0.06	6.00	.36	8.88	42.662	8.797	44.555
8	224 53 09.2 ^{3613.4}	13.4	0.08	6.08	.39	8.88	42.800	8.705	44.576
9	225 53 24.1 ^{3614.9}	13.6	0.06	6.18	.37	8.88	42.938	8.661	44.606
10	226 53 40.5 ^{3616.4}	+13.7	-0.01	+6.32	-0.33	8.89	+43.075	- 8.667	44.633
11	227 53 58.3 ^{3617.8}	13.8	+0.06	6.48	.26	8.89	43.213	8.714	44.654
12	228 54 17.5 ^{3619.2}	13.9	0.16	6.65	.17	8.89	43.351	8.788	44.659
13	229 54 38.2 ^{3620.7}	13.9	0.27	6.85	- .07	8.89	43.488	8.873	44.647
14	230 55 00.5 ^{3622.3}	14.0	0.39	7.05	+ .05	8.89	43.626	8.952	44.619
15	231 55 24.2 ^{3623.7}	+14.1	+0.52	+7.25	+0.18	8.90	+43.763	- 9.013	44.576
16	232 55 49.4 ^{3625.2}	+14.2	+0.65	+7.46	+0.30	8.90	+43.901	- 9.040	44.522

To obtain the longitude referred to the mean equinox of 1950-0, subtract 14' 14".6.

SUN, 1967
FOR 0^h EPHEMERIS TIME

31

Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Ephemeris Transit
	^h ^m ^s	[°] ['] ^{''}		['] ^{''}	^h ^m ^s [°]
Oct. 1	12 26 10.61 217.18	- 2 49 46.0 -1398.6	1.001 2769 -2832	15 59.95	11 49 51.55 - 19.22
2	12 29 47.79 217.49	3 13 04.6 1396.5	.000 9937 2849	16 00.23	11 49 32.33 18.90
3	12 33 25.28 217.79	3 36 21.1 1394.1	.000 7088 2868	16 00.50	11 49 13.43 18.59
4	12 37 03.07 218.13	3 59 35.2 1391.3	.000 4220 2886	16 00.77	11 48 54.84 18.25
5	12 40 41.20 218.48	4 22 46.5 1388.2	1.000 1334 2903	16 01.05	11 48 36.59 17.90
6	12 44 19.68 218.84	- 4 45 54.7 -1384.5	0.999 8431 -2917	16 01.33	11 48 18.69 - 17.52
7	12 47 58.52 219.22	5 08 59.2 1380.6	.999 5514 2928	16 01.61	11 48 01.17 17.14
8	12 51 37.74 219.63	5 31 59.8 1376.3	.999 2586 2935	16 01.89	11 47 44.03 16.74
9	12 55 17.37 220.02	5 54 56.1 1371.5	.998 9651 2937	16 02.18	11 47 27.29 16.32
10	12 58 57.39 220.46	6 17 47.6 1366.3	.998 6714 2935	16 02.46	11 47 10.97 15.88
11	13 02 37.85 220.91	- 6 40 33.9 -1360.9	0.998 3779 -2930	16 02.74	11 46 55.09 - 15.42
12	13 06 18.76 221.38	7 03 14.8 1355.0	.998 0849 2920	16 03.02	11 46 39.67 14.94
13	13 10 00.14 221.86	7 25 49.8 1348.7	.997 7929 2909	16 03.31	11 46 24.73 14.43
14	13 13 42.00 222.38	7 48 18.5 1342.2	.997 5020 2892	16 03.59	11 46 10.30 13.92
15	13 17 24.38 222.90	8 10 40.7 1335.2	.997 2128 2875	16 03.87	11 45 56.38 13.37
16	13 21 07.28 223.46	- 8 32 55.9 -1328.0	0.996 9253 -2856	16 04.14	11 45 43.01 - 12.81
17	13 24 50.74 224.04	8 55 03.9 1320.3	.996 6397 2835	16 04.42	11 45 30.20 12.22
18	13 28 34.78 224.62	9 17 04.2 1312.2	.996 3562 2813	16 04.70	11 45 17.98 11.62
19	13 32 19.40 225.25	9 38 56.4 1304.0	.996 0749 2789	16 04.97	11 45 06.36 11.00
20	13 36 04.65 225.88	10 00 40.4 1295.1	.995 7960 2766	16 05.24	11 44 55.36 10.36
21	13 39 50.53 226.53	-10 22 15.5 -1286.2	0.995 5194 -2743	16 05.51	11 44 45.00 - 9.69
22	13 43 37.06 227.21	10 43 41.7 1276.6	.995 2451 2720	16 05.77	11 44 35.31 9.02
23	13 47 24.27 227.90	11 04 58.3 1266.8	.994 9731 2697	16 06.04	11 44 26.29 8.32
24	13 51 12.17 228.60	11 26 05.1 1256.5	.994 7034 2676	16 06.30	11 44 17.97 7.60
25	13 55 00.77 229.32	11 47 01.6 1246.0	.994 4358 2657	16 06.56	11 44 10.37 6.88
26	13 58 50.09 230.06	-12 07 47.6 -1234.9	0.994 1701 -2638	16 06.82	11 44 03.49 - 6.14
27	14 02 40.15 230.80	12 28 22.5 1223.5	.993 9063 2621	16 07.07	11 43 57.35 5.38
28	14 06 30.95 231.57	12 48 46.0 1211.7	.993 6442 2608	16 07.33	11 43 51.97 4.61
29	14 10 22.52 232.34	13 08 57.7 1199.3	.993 3834 2597	16 07.58	11 43 47.36 3.83
30	14 14 14.86 233.11	13 28 57.0 1186.7	.993 1237 2587	16 07.84	11 43 43.53 3.04
31	14 18 07.97 233.92	-13 48 43.7 -1173.6	0.992 8650 -2580	16 08.09	11 43 40.49 - 2.25
Nov. 1	14 22 01.89 234.71	14 08 17.3 1160.1	.992 6070 2574	16 08.34	11 43 38.24 1.45
2	14 25 56.60 235.51	14 27 37.4 1146.1	.992 3496 2567	16 08.59	11 43 36.79 - 0.64
3	14 29 52.11 236.33	14 46 43.5 1131.7	.992 0929 2560	16 08.84	11 43 36.15 + 0.16
4	14 33 48.44 237.14	15 05 35.2 1116.8	.991 8369 2549	16 09.09	11 43 36.31 0.97
5	14 37 45.58 237.95	-15 24 12.0 -1101.6	0.991 5820 -2538	16 09.34	11 43 37.28 + 1.78
6	14 41 43.53 238.76	15 42 33.6 1085.9	.991 3282 2522	16 09.59	11 43 39.06 2.60
7	14 45 42.29 239.58	16 00 39.5 1069.8	.991 0760 2501	16 09.83	11 43 41.66 3.41
8	14 49 41.87 240.40	16 18 29.3 1053.2	.990 8259 2477	16 10.08	11 43 45.07 4.24
9	14 53 42.27 241.21	16 36 02.5 1036.3	.990 5782 2450	16 10.32	11 43 49.31 5.07
10	14 57 43.48 242.05	-16 53 18.8 -1018.9	0.990 3332 -2418	16 10.56	11 43 54.38 + 5.90
11	15 01 45.53 242.87	17 10 17.7 1001.3	.990 0914 2383	16 10.80	11 44 00.28 6.73
12	15 05 48.40 243.70	17 26 59.0 983.1	.989 8531 2347	16 11.03	11 44 07.01 7.57
13	15 09 52.10 244.55	17 43 22.1 964.7	.989 6184 2308	16 11.26	11 44 14.58 8.40
14	15 13 56.65 245.38	17 59 26.8 945.8	.989 3876 2265	16 11.49	11 44 22.98 9.24
15	15 18 02.03 246.23	-18 15 12.6 - 926.6	0.989 1611 -2222	16 11.71	11 44 32.22 + 10.09
16	15 22 08.26	-18 30 39.2	0.988 9389	16 11.93	11 44 42.31

SUN, 1967
FOR 0^h EPHEMERIS TIME

Date	Longitude Mean Equinox of 1967.0	Redn. to App. Long.	Latitude Ecliptic of		Date	Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic	
			1967.0	1950.0					23° 26'	
Nov. 16	232 55 49.4 3626.8	+14.2	+0.65	+7.46	+0.30	8.90	+43.901	- 9.040	44.522	
17	233 56 16.2 3628.3	14.3	0.77	7.65	.42	8.90	44.039	9.032	44.463	
18	234 56 44.5 3630.0	14.5	0.88	7.83	.52	8.90	44.176	8.982	44.409	
19	235 57 14.5 3631.5	14.7	0.98	8.00	.61	8.90	44.314	8.898	44.362	
20	236 57 46.0 3633.2	14.9	1.05	8.14	.68	8.91	44.452	8.789	44.331	
21	237 58 19.2 3634.9	+15.2	+1.10	+8.25	+0.73	8.91	+44.589	- 8.670	44.318	
22	238 58 54.1 3636.6	15.5	1.12	8.33	.74	8.91	44.727	8.556	44.324	
23	239 59 30.7 3638.2	15.7	1.11	8.38	.72	8.91	44.865	8.465	44.347	
24	241 00 08.9 3640.0	15.9	1.06	8.39	.68	8.91	45.002	8.409	44.379	
25	242 00 48.9 3641.6	16.0	0.99	8.37	.60	8.91	45.140	8.399	44.413	
26	243 01 30.5 3643.3	+16.1	+0.89	+8.33	+0.50	8.92	+45.278	- 8.430	44.438	
27	244 02 13.8 3644.9	16.2	0.77	8.26	.37	8.92	45.415	8.488	44.443	
28	245 02 58.7 3646.4	16.3	0.63	8.17	.23	8.92	45.553	8.549	44.421	
29	246 03 45.1 3647.9	16.4	0.49	8.08	+ .09	8.92	45.690	8.583	44.375	
30	247 04 33.0 3649.2	16.5	0.35	7.98	- .06	8.92	45.828	8.559	44.310	
Dec. 1	248 05 22.2 3650.5	+16.7	+0.23	+7.89	-0.19	8.92	+45.966	- 8.467	44.241	
2	249 06 12.7 3651.7	17.0	0.11	7.82	.30	8.93	46.103	8.312	44.185	
3	250 07 04.4 3652.7	17.4	+0.03	7.77	.39	8.93	46.241	8.123	44.153	
4	251 07 57.1 3653.6	17.7	-0.03	7.75	.45	8.93	46.379	7.933	44.151	
5	252 08 50.7 3654.5	18.0	0.06	7.75	.48	8.93	46.516	7.776	44.172	
6	253 09 45.2 3655.2	+18.2	-0.05	+7.79	-0.48	8.93	+46.654	- 7.669	44.209	
7	254 10 40.4 3656.0	18.4	-0.01	7.85	.45	8.93	46.792	7.617	44.249	
8	255 11 36.4 3656.7	18.5	+0.05	7.94	.39	8.93	46.929	7.613	44.283	
9	256 12 33.1 3657.4	18.6	0.13	8.05	.30	8.93	47.067	7.644	44.303	
10	257 13 30.5 3658.0	18.7	0.24	8.17	.20	8.94	47.204	7.692	44.308	
11	258 14 28.5 3658.6	+18.8	+0.35	+8.30	-0.09	8.94	+47.342	- 7.740	44.294	
12	259 15 27.1 3659.3	18.9	0.47	8.44	+ .03	8.94	47.480	7.773	44.265	
13	260 16 26.4 3659.9	19.0	0.59	8.57	.15	8.94	47.617	7.779	44.226	
14	261 17 26.3 3660.6	19.2	0.71	8.70	.26	8.94	47.755	7.748	44.181	
15	262 18 26.9 3661.1	19.4	0.81	8.81	.36	8.94	47.893	7.678	44.136	
16	263 19 28.0 3661.8	+19.7	+0.90	+8.90	+0.45	8.94	+48.030	- 7.573	44.100	
17	264 20 29.8 3662.5	19.9	0.97	8.97	.52	8.94	48.168	7.440	44.079	
18	265 21 32.3 3663.2	20.2	1.02	9.01	.56	8.94	48.306	7.292	44.075	
19	266 22 35.5 3663.8	20.5	1.04	9.03	.58	8.94	48.443	7.147	44.091	
20	267 23 39.3 3664.6	20.7	1.02	9.01	.57	8.94	48.581	7.025	44.125	
21	268 24 43.9 3665.3	+21.0	+0.98	+8.97	+0.53	8.95	+48.718	- 6.940	44.172	
22	269 25 49.2 3666.1	21.1	0.92	8.89	.46	8.95	48.856	6.898	44.220	
23	270 26 55.3 3666.8	21.3	0.82	8.78	.37	8.95	48.994	6.900	44.263	
24	271 28 02.1 3667.5	21.4	0.71	8.65	.25	8.95	49.131	6.934	44.289	
25	272 29 09.6 3668.2	21.5	0.57	8.50	+ .12	8.95	49.269	6.980	44.292	
26	273 30 17.8 3668.8	+21.6	+0.43	+8.34	-0.02	8.95	+49.407	- 7.010	44.271	
27	274 31 26.6 3669.4	21.7	0.29	8.17	.16	8.95	49.544	6.996	44.229	
28	275 32 36.0 3669.9	21.9	0.16	8.02	.30	8.95	49.682	6.923	44.180	
29	276 33 45.9 3670.2	22.2	+0.05	7.88	.41	8.95	49.820	6.785	44.134	
30	277 34 56.1 3670.5	22.5	-0.04	7.75	.50	8.95	49.957	6.601	44.111	
31	278 36 06.6 3670.7	+22.9	-0.11	+7.65	-0.57	8.95	+50.095	- 6.401	44.114	
32	279 37 17.3	+23.2	-0.16	+7.57	-0.61	8.95	+50.232	- 6.218	44.144	

To obtain the longitude referred to the mean equinox of 1950.0, subtract 14' 14".6.

SUN, 1967
FOR 0^h EPHEMERIS TIME

33

Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Ephemeris Transit
	^h ^m ^s	[°] ['] ["]			^h ^m ^s
Nov. 16	15 22 08.26 ^s	-18 30 39.2 ^s	0.988 9389	16 11.93	11 44 42.31 ^s
17	15 26 15.33 ^s	18 45 46.2 ^s	.988 7212 ^s	16 12.14	11 44 53.23 ^s
18	15 30 23.23 ^s	19 00 33.3 ^s	.988 5081 ^s	16 12.35	11 45 04.99 ^s
19	15 34 31.98 ^s	19 15 00.1 ^s	.988 2996 ^s	16 12.56	11 45 17.59 ^s
20	15 38 41.57 ^s	19 29 06.3 ^s	.988 0958 ^s	16 12.76	11 45 31.02 ^s
21	15 42 51.98 ^s	-19 42 51.4 ^s	0.987 8966 ^s	16 12.96	11 45 45.28 ^s
22	15 47 03.21 ^s	19 56 15.1 ^s	.987 7019 ^s	16 13.15	11 46 00.35 ^s
23	15 51 15.26 ^s	20 09 17.1 ^s	.987 5118 ^s	16 13.34	11 46 16.24 ^s
24	15 55 28.12 ^s	20 21 57.0 ^s	.987 3260 ^s	16 13.52	11 46 32.94 ^s
25	15 59 41.78 ^s	20 34 14.5 ^s	.987 1443 ^s	16 13.70	11 46 50.43 ^s
26	16 03 56.22 ^s	-20 46 09.1 ^s	0.986 9665 ^s	16 13.87	11 47 08.70 ^s
27	16 08 11.43 ^s	20 57 40.6 ^s	.986 7922 ^s	16 14.04	11 47 27.74 ^s
28	16 12 27.40 ^s	21 08 48.5 ^s	.986 6213 ^s	16 14.21	11 47 47.53 ^s
29	16 16 44.11 ^s	21 19 32.6 ^s	.986 4534 ^s	16 14.38	11 48 08.05 ^s
30	16 21 01.55 ^s	21 29 52.5 ^s	.986 2885 ^s	16 14.54	11 48 29.28 ^s
Dec. 1	16 25 19.68 ^s	-21 39 47.9 ^s	0.986 1262 ^s	16 14.70	11 48 51.19 ^s
2	16 29 38.49 ^s	21 49 18.6 ^s	.985 9666 ^s	16 14.86	11 49 13.76 ^s
3	16 33 57.94 ^s	21 58 24.1 ^s	.985 8097 ^s	16 15.02	11 49 36.96 ^s
4	16 38 18.01 ^s	22 07 04.2 ^s	.985 6556 ^s	16 15.17	11 50 00.76 ^s
5	16 42 38.66 ^s	22 15 18.7 ^s	.985 5045 ^s	16 15.32	11 50 25.14 ^s
6	16 46 59.87 ^s	-22 23 07.2 ^s	0.985 3568 ^s	16 15.46	11 50 50.06 ^s
7	16 51 21.61 ^s	22 30 29.5 ^s	.985 2127 ^s	16 15.61	11 51 15.49 ^s
8	16 55 43.85 ^s	22 37 25.4 ^s	.985 0728 ^s	16 15.75	11 51 41.42 ^s
9	17 00 06.56 ^s	22 43 54.7 ^s	.984 9372 ^s	16 15.88	11 52 07.82 ^s
10	17 04 29.72 ^s	22 49 57.1 ^s	.984 8063 ^s	16 16.01	11 52 34.65 ^s
11	17 08 53.31 ^s	-22 55 32.4 ^s	0.984 6803 ^s	16 16.13	11 53 01.89 ^s
12	17 13 17.29 ^s	23 00 40.7 ^s	.984 5595 ^s	16 16.25	11 53 29.50 ^s
13	17 17 41.63 ^s	23 05 21.5 ^s	.984 4440 ^s	16 16.37	11 53 57.48 ^s
14	17 22 06.32 ^s	23 09 34.8 ^s	.984 3342 ^s	16 16.48	11 54 25.77 ^s
15	17 26 31.32 ^s	23 13 20.5 ^s	.984 2302 ^s	16 16.58	11 54 54.36 ^s
16	17 30 56.60 ^s	-23 16 38.6 ^s	0.984 1321 ^s	16 16.68	11 55 23.22 ^s
17	17 35 22.13 ^s	23 19 28.8 ^s	.984 0401 ^s	16 16.77	11 55 52.31 ^s
18	17 39 47.89 ^s	23 21 51.0 ^s	.983 9542 ^s	16 16.85	11 56 21.61 ^s
19	17 44 13.83 ^s	23 23 45.3 ^s	.983 8744 ^s	16 16.93	11 56 51.09 ^s
20	17 48 39.94 ^s	23 25 11.5 ^s	.983 8008 ^s	16 17.01	11 57 20.71 ^s
21	17 53 06.18 ^s	-23 26 09.5 ^s	0.983 7333 ^s	16 17.07	11 57 50.46 ^s
22	17 57 32.52 ^s	23 26 39.4 ^s	.983 6716 ^s	16 17.14	11 58 20.29 ^s
23	18 01 58.92 ^s	23 26 41.1 ^s	.983 6157 ^s	16 17.19	11 58 50.17 ^s
24	18 06 25.37 ^s	23 26 14.5 ^s	.983 5652 ^s	16 17.24	11 59 20.08 ^s
25	18 10 51.82 ^s	23 25 19.6 ^s	.983 5199 ^s	16 17.29	11 59 49.98 ^s
26	18 15 18.24 ^s	-23 23 56.4 ^s	0.983 4794 ^s	16 17.33	12 00 19.83 ^s
27	18 19 44.60 ^s	23 22 05.0 ^s	.983 4434 ^s	16 17.36	12 00 49.60 ^s
28	18 24 10.87 ^s	23 19 45.4 ^s	.983 4117 ^s	16 17.39	12 01 19.26 ^s
29	18 28 37.00 ^s	23 16 57.6 ^s	.983 3841 ^s	16 17.42	12 01 48.76 ^s
30	18 33 02.97 ^s	23 13 41.8 ^s	.983 3601 ^s	16 17.44	12 02 18.06 ^s
31	18 37 28.72 ^s	-23 09 58.0 ^s	0.983 3397 ^s	16 17.46	12 02 47.14 ^s
32	18 41 54.22 ^s	23 05 46.4 ^s	0.983 3229 ^s	16 17.48	12 03 15.94 ^s

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1967-0

Date	X			Y			Z		
Jan. 0	+0.151	4286	+17 2515 - 460	-0.891	3720	+ 2 6209 + 2766	-0.386	5345	+1 1364 +1198
1	.168	6801	17 2008 507	.888	7511	2 8969 2760	.385	3981	1 2559 1195
2	.185	8809	17 1446 562	.885	8542	3 1724 2755	.384	1422	1 3752 1193
3	.203	0255	17 0832 614	.882	6818	3 4470 2746	.382	7670	1 4942 1190
4	.220	1087	17 0164 668	.879	2348	3 7214 2744	.381	2728	1 6131 1189
5	+0.237	1251	+16 9411 - 723	-0.875	5134	+ 3 9947 +2733	-0.379	6597	+1 7316 +1185
6	.254	0692	16 8660 781	.871	5187	4 2672 2725	.377	9281	1 8497 1181
7	.270	9352	16 7828 832	.867	2515	4 5382 2710	.376	0784	1 9674 1177
8	.287	7180	16 6938 890	.862	7133	4 8082 2700	.374	1110	2 0844 1170
9	.304	4118	16 5990 948	.857	9051	5 0767 2685	.372	0266	2 2010 1166
10	+0.321	0108	+16 4991 - 999	-0.852	8284	+ 5 3433 +2666	-0.369	8256	+2 3168 +1158
11	.337	5099	16 3932 1059	.847	4851	5 6083 2650	.367	5088	2 4318 1150
12	.353	9031	16 2823 1109	.841	8768	5 8713 2630	.365	0770	2 5460 1142
13	.370	1854	16 1661 1162	.836	0055	6 1321 2608	.362	5310	2 6593 1133
14	.386	3515	16 0445 1216	.829	8734	6 3908 2587	.359	8717	2 7716 1123
15	+0.402	3960	+15 9180 -1265	-0.823	4826	+ 6 6472 +2564	-0.357	1001	+2 8828 +1112
16	.418	3140	15 7866 1314	.816	8354	6 9012 2540	.354	2173	2 9932 1104
17	.434	1006	15 6502 1364	.809	9342	7 1526 2514	.351	2241	3 1023 1091
18	.449	7508	15 5090 1412	.802	7816	7 4018 2492	.348	1218	3 2103 1080
19	.465	2598	15 3631 1459	.795	3798	7 6481 2463	.344	9115	3 3172 1069
20	+0.480	6229	+15 2129 -1502	-0.787	7317	+ 7 8919 +2438	-0.341	5943	+3 4229 +1057
21	.495	8358	15 0578 1551	.779	8398	8 1328 2409	.338	1714	3 5274 1045
22	.510	8936	14 8987 1591	.771	7070	8 3711 2383	.334	6440	3 6306 1032
23	.525	7923	14 7351 1636	.763	3359	8 6065 2354	.331	0134	3 7326 1020
24	.540	5274	14 5677 1674	.754	7294	8 8393 2328	.327	2808	3 8334 1008
25	+0.555	0951	+14 3959 -1718	-0.745	8901	+ 9 0690 +2297	-0.323	4474	+3 9329 +995
26	.569	4910	14 2205 1754	.736	8211	9 2961 2271	.319	5145	4 0313 984
27	.583	7115	14 0407 1798	.727	5250	9 5206 2245	.315	4832	4 1284 971
28	.597	7522	13 8571 1836	.718	0044	9 7423 2217	.311	3548	4 2244 960
29	.611	6093	13 6695 1876	.708	2621	9 9613 2190	.307	1304	4 3192 948
30	+0.625	2788	+13 4777 -1918	-0.698	3008	+10 1776 +2163	-0.302	8112	+4 4128 +936
31	.638	7565	13 2817 1960	.688	1232	10 3909 2133	.298	3984	4 5053 925
Feb. 1	.652	0382	13 0816 2001	.677	7323	10 6014 2105	.293	8931	4 5965 912
2	.665	1198	12 8773 2043	.667	1309	10 8087 2073	.289	2966	4 6866 901
3	.677	9971	12 6686 2087	.656	3222	11 0128 2041	.284	6100	4 7750 884
4	+0.690	6657	+12 4559 -2127	-0.645	3094	+11 2137 +2009	-0.279	8350	+4 8621 +871
5	.703	1216	12 2389 2170	.634	0957	11 4108 1971	.274	9729	4 9477 856
6	.715	3605	12 0181 2208	.622	6849	11 6044 1936	.270	0252	5 0318 841
7	.727	3786	11 7932 2249	.611	0805	11 7941 1897	.264	9934	5 1143 825
8	.739	1718	11 5645 2287	.599	2864	11 9802 1861	.259	8791	5 1951 808
9	+0.750	7363	+11 3321 -2324	-0.587	3062	+12 1621 +1819	-0.254	6840	+5 2741 +790
10	.762	0684	11 0961 2360	.575	1441	12 3397 1776	.249	4099	5 3513 772
11	.773	1645	10 8568 2393	.562	8044	12 5136 1739	.244	0586	5 4267 754
12	.784	0213	10 6141 2427	.550	2908	12 6829 1693	.238	6319	5 5004 737
13	.794	6354	10 3684 2457	.537	6079	12 8481 1652	.233	1315	5 5721 717
14	+0.805	0038	+10 1196 -2488	-0.524	7598	+13 0091 +1610	-0.227	5594	+5 6418 +697
15	+0.815	1234	-2517	-0.511	7507	+13 0091 +1565	-0.221	9176	+5 6418 +681

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1967-0

Date	X			Y			Z		
Feb. 15	+0.815 1234	+ 9 8679	-2517	-0.511 7507	+13 1656	+1565	-0.221 9176	+5 7099	+ 681
16	.824 9913	9 6135	2544	.498 5851	13 3177	1521	.216 2077	5 7758	659
17	.834 6048	9 3566	2569	.485 2674	13 4655	1478	.210 4319	5 8398	640
18	.843 9614	9 0972	2594	.471 8019	13 6089	1434	.204 5921	5 9020	622
19	.853 0586	8 8354	2618	.458 1930	13 7480	1391	.198 6901	5 9620	600
20	+0.861 8940	+ 8 5713	-2641	-0.444 4450	+13 8824	+1344	-0.192 7281	+6 0205	+ 585
21	.870 4653	8 3056	2657	.430 5626	14 0127	1303	.186 7076	6 0767	562
22	.878 7709	8 0375	2681	.416 5499	14 1386	1259	.180 6309	6 1312	545
23	.886 8084	7 7679	2696	.402 4113	14 2604	1218	.174 4997	6 1838	526
24	.894 5763	7 4961	2718	.388 1509	14 3781	1177	.168 3159	6 2346	508
25	+0.902 0724	+ 7 2226	-2735	-0.373 7728	+14 4915	+1134	-0.162 0813	+6 2838	+ 492
26	.909 2950	6 9472	2754	.359 2813	14 6011	1096	.155 7975	6 3310	472
27	.916 2422	6 6698	2774	.344 6802	14 7063	1052	.149 4665	6 3767	457
28	.922 9120	6 3904	2794	.329 9739	14 8075	1012	.143 0898	6 4204	437
Mar. 1	.929 3024	6 1092	2812	.315 1664	14 9044	969	.136 6694	6 4625	421
2	+0.935 4116	+ 5 8258	-2834	-0.300 2620	+14 9970	+ 926	-0.130 2069	+6 5027	+ 402
3	.941 2374	5 5405	2853	.285 2650	15 0851	881	.123 7042	6 5409	382
4	.946 7779	5 2534	2871	.270 1799	15 1685	834	.117 1633	6 5773	364
5	.952 0313	4 9645	2889	.255 0114	15 2473	788	.110 5860	6 6114	341
6	.956 9958	4 6741	2904	.239 7641	15 3215	742	.103 9746	6 6439	325
7	+0.961 6699	+ 4 3821	-2920	-0.224 4426	+15 3905	+ 690	-0.097 3307	+6 6738	+ 299
8	.966 0520	4 0887	2934	.209 0521	15 4548	643	.090 6569	6 7020	282
9	.970 1407	3 7941	2946	.193 5973	15 5140	592	.083 9549	6 7278	258
10	.973 9348	3 4986	2955	.178 0833	15 5684	544	.077 2271	6 7515	237
11	.977 4334	3 2019	2967	.162 5149	15 6176	492	.070 4756	6 7729	214
12	+0.980 6353	+ 2 9047	-2972	-0.146 8973	+15 6620	+ 444	-0.063 7027	+6 7922	+ 193
13	.983 5400	2 6070	2977	.131 2353	15 7013	393	.056 9105	6 8094	172
14	.986 1470	2 3085	2985	.115 5340	15 7355	342	.050 1011	6 8242	148
15	.988 4555	2 0099	2986	.099 7985	15 7648	293	.043 2769	6 8370	128
16	.990 4654	1 7111	2988	.084 0337	15 7890	242	.036 4399	6 8474	104
17	+0.992 1765	+ 1 4122	-2989	-0.068 2447	+15 8084	+ 194	-0.029 5925	+6 8558	+ 84
18	.993 5887	1 1134	2988	.052 4363	15 8229	145	.022 7367	6 8619	61
19	.994 7021	8148	2986	.036 6134	15 8323	94	.015 8748	6 8661	42
20	.995 5169	5168	2980	.020 7811	15 8371	48	.009 0087	6 8679	+ 18
21	.996 0337	+ 2190	2978	-.004 9440	15 8372	+ 1	-.002 1408	6 8677	- 2
22	+0.996 2527	- 779	-2969	+0.010 8932	+15 8326	- 46	+0.004 7269	+6 8656	- 21
23	.996 1748	3745	2966	.026 7258	15 8237	89	.011 5925	6 8616	40
24	.995 8003	6702	2957	.042 5495	15 8101	136	.018 4541	6 8555	61
25	.995 1301	9654	2952	.058 3596	15 7925	176	.025 3096	6 8478	77
26	.994 1647	1 2599	2945	.074 1521	15 7706	219	.032 1574	6 8381	97
27	+0.992 9048	- 1 5541	-2942	+0.089 9227	+15 7443	- 263	+0.038 9955	+6 8266	- 115
28	.991 3507	1 8475	2934	.105 6670	15 7136	307	.045 8221	6 8134	132
29	.989 5032	2 1406	2931	.121 3806	15 6790	346	.052 6355	6 7983	151
30	.987 3626	2 4332	2926	.137 0596	15 6395	395	.059 4338	6 7813	170
31	.984 9294	2 7252	2920	.152 6991	15 5957	438	.066 2151	6 7625	188
Apr. 1	+0.982 2042	- 3 0165	-2913	+0.168 2948	+15 5473	- 484	+0.072 9776	+6 7415	- 210
2	+0.979 1877	-2906	+0.183 8421	-531	+0.079 7191	-228			

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
 MEAN EQUATOR AND EQUINOX OF 1967.0

Date	X			Y			Z		
Apr. 1	+0.982 2042	- 3 0165	-2913	+0.168 2948	+15 5473	- 484	+0.072 9776	+6 7415	- 210
2	.979 1877	3 3071	2906	.183 8421	15 4942	531	.079 7191	6 7187	228
3	.975 8806	3 5967	2896	.199 3363	15 4364	578	.086 4378	6 6938	249
4	.972 2839	3 8853	2886	.214 7727	15 3740	624	.093 1316	6 6668	270
5	.968 3986	4 1728	2875	.230 1467	15 3068	672	.099 7984	6 6378	290
6	+0.964 2258	- 4 4589	-2861	+0.245 4535	+15 2347	- 721	+0.106 4362	+6 6069	- 309
7	.959 7669	4 7434	2845	.260 6882	15 1583	764	.113 0431	6 5737	332
8	.955 0235	5 0266	2832	.275 8465	15 0770	813	.119 6168	6 5385	352
9	.949 9969	5 3077	2811	.290 9235	14 9910	860	.126 1553	6 5014	371
10	.944 6892	5 5872	2795	.305 9145	14 9006	904	.132 6567	6 4622	392
11	+0.939 1020	- 5 8646	-2774	+0.320 8151	+14 8054	- 952	+0.139 1189	+6 4210	- 412
12	.933 2374	6 1398	2752	.335 6205	14 7061	993	.145 5399	6 3779	431
13	.927 0976	6 4129	2731	.350 3266	14 6020	1041	.151 9178	6 3326	453
14	.920 6847	6 6835	2706	.364 9286	14 4937	1083	.158 2504	6 2856	470
15	.914 0012	6 9517	2682	.379 4223	14 3810	1127	.164 5360	6 2367	489
16	+0.907 0495	- 7 2172	-2655	+0.393 8033	+14 2644	-1166	+0.170 7727	+6 1859	- 508
17	.899 8323	7 4801	2629	.408 0677	14 1435	1209	.176 9586	6 1334	525
18	.892 3522	7 7400	2599	.422 2112	14 0189	1246	.183 0920	6 0791	543
19	.884 6122	7 9973	2573	.436 2301	13 8903	1286	.189 1711	6 0232	559
20	.876 6149	8 2517	2544	.450 1204	13 7580	1323	.195 1943	5 9657	575
21	+0.868 3632	- 8 5032	-2515	+0.463 8784	+13 6223	-1357	+0.201 1600	+5 9067	- 590
22	.859 8600	8 7519	2487	.477 5007	13 4831	1392	.207 0667	5 8462	605
23	.851 1081	8 9980	2461	.490 9838	13 3405	1426	.212 9129	5 7843	619
24	.842 1101	9 2413	2433	.504 3243	13 1945	1460	.218 6972	5 7210	633
25	.832 8688	9 4819	2406	.517 5188	13 0452	1493	.224 4182	5 6561	649
26	+0.823 3869	- 9 7203	-2384	+0.530 5640	+12 8925	-1527	+0.230 0743	+5 5900	- 661
27	.813 6666	9 9557	2354	.543 4565	12 7362	1563	.235 6643	5 5224	676
28	.803 7109	10 1886	2329	.556 1927	12 5765	1597	.241 1867	5 4532	692
29	.793 5223	10 4189	2303	.568 7692	12 4131	1634	.246 6399	5 3826	706
30	.783 1034	10 6463	2274	.581 1823	12 2462	1669	.252 0225	5 3103	723
May 1	+0.772 4571	-10 8708	-2245	+0.593 4285	+12 0756	-1706	+0.257 3328	+5 2365	- 738
2	.761 5863	11 0920	2212	.605 5041	11 9015	1741	.262 5693	5 1612	753
3	.750 4943	11 3102	2182	.617 4056	11 7237	1778	.267 7305	5 0841	771
4	.739 1841	11 5249	2147	.629 1293	11 5425	1812	.272 8146	5 0058	783
5	.727 6592	11 7363	2114	.640 6718	11 3579	1846	.277 8204	4 9258	800
6	+0.715 9229	-11 9442	-2079	+0.652 0297	+11 1696	-1883	+0.282 7462	+4 8443	- 815
7	.703 9787	12 1483	2041	.663 1993	10 9784	1912	.287 5905	4 7613	830
8	.691 8304	12 3488	2005	.674 1777	10 7835	1949	.292 3518	4 6770	843
9	.679 4816	12 5453	1965	.684 9612	10 5857	1978	.297 0288	4 5910	860
10	.666 9363	12 7380	1927	.695 5469	10 3846	2011	.301 6198	4 5039	871
11	+0.654 1983	-12 9265	-1885	+0.705 9315	+10 1807	-2039	+0.306 1237	+4 4154	- 885
12	.641 2718	13 1109	1844	.716 1122	9 9738	2069	.310 5391	4 3255	899
13	.628 1609	13 2911	1802	.726 0860	9 7641	2097	.314 8646	4 2345	910
14	.614 8698	13 4672	1761	.735 8501	9 5516	2125	.319 0991	4 1422	923
15	.601 4026	13 6385	1713	.745 4017	9 3369	2147	.323 2413	4 0488	934
16	+0.587 7641	-13 8059	-1674	+0.754 7386	+ 9 1197	-2172	+0.327 2901	+3 9545	- 943
17	+0.573 9582	-1627	-1627	+0.763 8583	-2196	-2196	+0.331 2446	- 953	- 953

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1967-0

Date	X			Y			Z		
May	17	+0.573 9582	-13 9686 -1627	+0.763 8583	+ 8 9001 -2196	+0.331 2446	+3 8592 -	953	
	18	.559 9896	14 1273 1587	.772 7584	8 6786 2215	.335 1038	3 7629	963	
	19	.545 8623	14 2814 1541	.781 4370	8 4550 2236	.338 8667	3 6659	970	
	20	.531 5809	14 4315 1501	.789 8920	8 2297 2253	.342 5326	3 5679	980	
	21	.517 1494	14 5774 1459	.798 1217	8 0024 2273	.346 1005	3 4695	984	
	22	+0.502 5720	-14 7192 -1418	+0.806 1241	-2290	+0.349 5700	+3 3701 -	994	
	23	.487 8528	14 8572 1380	.813 8975	+ 7 7734 2309	.352 9401	3 2701	1000	
	24	.472 9956	14 9912 1340	.821 4400	7 5425 2325	.356 2102	3 1693	1008	
	25	.458 0044	15 1214 1302	.828 7500	7 3100 2347	.359 3795	3 0676	1017	
	26	.442 8830	15 2473 1259	.835 8253	6 8391 2362	.362 4471	2 9654	1022	
	27	+0.427 6357	-15 3697 -1224	+0.842 6644	+ 6 6007 -2384	+0.365 4125	+2 8621 -	1033	
	28	.412 2660	15 4877 1180	.849 2651	6 3605 2402	.368 2746	2 7581	1040	
	29	.396 7783	15 6016 1139	.855 6256	6 1182 2423	.371 0327	2 6532	1049	
	30	.381 1767	15 7114 1098	.861 7438	5 8741 2441	.373 6859	2 5476	1056	
	31	.365 4653	15 8163 1049	.867 6179	5 6283 2458	.376 2335	2 4411	1065	
June	1	+0.349 6490	-15 9171 -1008	+0.873 2462	-2477	+0.378 6746	+2 3337 -	1074	
	2	.333 7319	16 0133 962	.878 6268	+ 5 3806 2492	.381 0083	2 2258	1079	
	3	.317 7186	16 0133 914	.883 7582	5 1314 2511	.383 2341	2 1169	1089	
	4	.301 6139	16 1915 868	.888 6385	4 8803 2524	.385 3510	2 0076	1093	
	5	.285 4224	16 2737 822	.893 2664	4 6279 2538	.387 3586	1 8974	1102	
	6	+0.269 1487	-16 3508 -771	+0.897 6405	+ 4 1188 -2553	+0.389 2560	+1 7867 -	1107	
	7	.252 7979	16 4231 723	.901 7593	3 8624 2564	.391 0427	1 6756	1111	
	8	.236 3748	16 4904 673	.905 6217	3 6047 2577	.392 7183	1 5636	1120	
	9	.219 8844	16 5527 623	.909 2264	3 3461 2586	.394 2819	1 4514	1122	
	10	.203 3317	16 6100 573	.912 5725	3 0866 2595	.395 7333	1 3387	1127	
	11	+0.186 7217	-16 6621 -521	+0.915 6591	-2601	+0.397 0720	+1 2258 -	1129	
	12	.170 0596	16 7091 470	.918 4856	+ 2 8265 2607	.398 2978	1 1125	1133	
	13	.153 3505	16 7513 422	.921 0514	2 5658 2613	.399 4103	9990	1135	
	14	.136 5992	16 7882 369	.923 3559	2 3045 2613	.400 4093	8856	1134	
	15	.119 8110	16 8204 322	.925 3991	2 0432 2615	.401 2949	7721	1135	
	16	+0.102 9906	-16 8477 -273	+0.927 1808	-2618	+0.402 0670	+ 6584 -	1137	
	17	.086 1429	16 8703 226	.928 7007	+ 1 5199 2616	.402 7254	5449	1135	
	18	.069 2726	16 8882 179	.929 9590	1 2583 2616	.403 2703	4315	1134	
	19	.052 3844	16 9018 136	.930 9557	9967 2614	.403 7018	3181	1134	
	20	.035 4826	16 9109 91	.931 6910	7353 2615	.404 0199	2049	1132	
	21	+0.018 5717	-16 9155 -46	+0.932 1648	-2613	+0.404 2248	+ 916 -	1133	
	22	+ .001 6562	16 9160 -5	.932 3773	+ 2125 2613	.404 3164	216	1132	
	23	- .015 2598	16 9120 +40	.932 3285	488 2613	.404 2948	1347	1131	
	24	.032 1718	16 9036 84	.932 0184	3101 2611	.404 1601	2478	1131	
	25	.049 0754	16 8908 128	.931 4472	5712 2616	.403 9123	3610	1132	
	26	-0.065 9662	+ 173	+0.930 6144	-2613	+0.403 5513	- 4743 -	1133	
	27	.082 8397	16 8735 220	.929 5203	+ 1 0941 2612	.403 0770	5873	1130	
	28	.099 6912	16 8249 266	.928 1650	1 3553 2612	.402 4897	7005	1132	
	29	.116 5161	16 7937 312	.926 5485	1 6165 2609	.401 7892	8136	1131	
	30	.133 3098	16 7575 362	.924 6711	1 8774 2608	.400 9756	9266	1130	
July	1	-0.150 0673	-16 7166 +409	+0.922 5329	-2602	+0.400 0490	-1 0393 -	1127	
	2	-0.166 7839	+ 458	+0.920 1345	-2 3984 -2597	+0.399 0097		1128	

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
 MEAN EQUATOR AND EQUINOX OF 1967.0

Date	X				Y				Z			
July	1	-0.150 0673	-16 7166	+ 409	+0.922 5329	- 2 3984	-2602	+0.400 0490	-1 0393	-1127		
	2	.166 7830	16 6708	458	.920 1345	2 6581	2597	.399 0097	1 1521	1128		
	3	.183 4547	16 6203	505	.917 4764	2 9176	2595	.397 8576	1 2645	1124		
	4	.200 0750	16 5649	554	.914 5588	3 1762	2586	.396 5931	1 3767	1122		
	5	.216 6309	16 5043	606	.911 3826	3 4340	2578	.395 2164	1 4887	1120		
	6	-0.233 1442	-16 4390	+ 653	+0.907 9486	- 3 6909	-2569	+0.393 7277	-1 6002	-1115		
	7	.249 5832	16 3684	706	.904 2577	3 9471	2562	.392 1275	1 7114	1112		
	8	.265 9516	16 2932	752	.900 3106	4 2021	2550	.390 4161	1 8220	1106		
	9	.282 2448	16 2126	806	.896 1085	4 4555	2534	.388 5941	1 9322	1102		
	10	.298 4574	16 1274	852	.891 6530	4 7076	2521	.386 6619	2 0417	1095		
	11	-0.314 5848	-16 0373	+ 901	+0.886 9454	- 4 9582	-2506	+0.384 6202	-2 1504	-1087		
	12	.330 6221	15 9425	948	.881 9872	5 2069	2487	.382 4698	2 2585	1081		
	13	.346 5646	15 8431	994	.876 7803	5 4539	2470	.380 2113	2 3657	1072		
	14	.362 4077	15 7394	1037	.871 3264	5 6989	2450	.377 8456	2 4720	1063		
	15	.378 1471	15 6312	1082	.865 6275	5 9421	2432	.375 3736	2 5775	1055		
	16	-0.393 7783	-15 5188	+1124	+0.859 6854	- 6 1834	-2413	+0.372 7961	-2 6820	-1045		
	17	.409 2971	15 4026	1162	.853 5020	6 4226	2392	.370 1141	2 7858	1038		
	18	.424 6997	15 2821	1205	.847 0794	6 6600	2374	.367 3283	2 8886	1028		
	19	.439 9818	15 1579	1242	.840 4194	6 8955	2355	.364 4397	2 9906	1020		
	20	.455 1397	15 0296	1283	.833 5239	7 1291	2336	.361 4491	3 0918	1012		
	21	-0.470 1693	-14 8976	+1320	+0.826 3948	- 7 3606	-2315	+0.358 3573	-3 1919	-1001		
	22	.485 0669	14 7617	1359	.819 0342	7 5907	2301	.355 1654	3 2916	997		
	23	.499 8286	14 6217	1400	.811 4435	7 8186	2279	.351 8738	3 3903	987		
	24	.514 4503	14 4779	1438	.803 6249	8 0449	2263	.348 4835	3 4883	980		
	25	.528 9282	14 3300	1479	.795 5800	8 2689	2240	.344 9952	3 5852	969		
	26	-0.543 2582	-14 1781	+1519	+0.787 3111	- 8 4914	-2225	+0.341 4100	-3 6817	-965		
	27	.557 4363	14 0220	1561	.778 8197	8 7116	2202	.337 7283	3 7771	954		
	28	.571 4583	13 8620	1600	.770 1081	8 9295	2179	.333 9512	3 8716	945		
	29	.585 3203	13 6978	1642	.761 1786	9 1454	2159	.330 0796	3 9651	935		
	30	.599 0181	13 5295	1683	.752 0332	9 3591	2137	.326 1145	4 0579	928		
Aug.	31	-0.612 5476	-13 3572	+1723	+0.742 6741	- 9 5701	-2110	+0.322 0566	-4 1495	-916		
	1	.625 9048	13 1807	1765	.733 1040	9 7789	2088	.317 9071	4 2400	905		
	2	.639 0855	13 0001	1806	.723 3251	9 9849	2060	.313 6671	4 3295	895		
	3	.652 0856	12 8154	1847	.713 3402	10 1884	2035	.309 3376	4 4179	884		
	4	.664 9010	12 6267	1887	.703 1518	10 3891	2007	.304 9197	4 5051	872		
	5	-0.677 5277	-12 4339	+1928	+0.692 7627	-10 5867	-1976	+0.300 4146	-4 5909	-858		
	6	.689 9616	12 2371	1968	.682 1760	10 7812	1945	.295 8237	4 6754	845		
	7	.702 1987	12 0364	2007	.671 3948	10 9725	1913	.291 1483	4 7585	831		
	8	.714 2351	11 8321	2043	.660 4223	11 1605	1880	.286 3898	4 8401	816		
	9	.726 0672	11 6242	2079	.649 2618	11 3448	1843	.281 5497	4 9203	802		
	10	-0.737 6914	-11 4129	+2113	+0.637 9170	-11 5258	-1810	+0.276 6294	-4 9988	-785		
	11	.749 1043	11 1982	2147	.626 3912	11 7033	1775	.271 6306	5 0757	769		
	12	.760 3025	10 9807	2175	.614 6879	11 8769	1736	.266 5549	5 1510	753		
	13	.771 2832	10 7603	2204	.602 8110	12 0473	1704	.261 4039	5 2249	739		
	14	.782 0435	10 5368	2235	.590 7637	12 2139	1666	.256 1790	5 2970	721		
	15	-0.792 5803	-10 3109	+2259	+0.578 5498	-12 3773	-1634	+0.250 8820	-5 3677	-707		
16	-0.802 8912	-10 0829	+2289	+0.566 1725	-12 5399	-1599	+0.245 5143	-5 4407	-693			

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1967.0

Date	X			Y			Z		
Aug. 16	-0.802 8912	-10 0820	+2289	+0.566 1725	-12 5372	-1599	+0.245 5143	-5 4370	- 693
17	.812 9732	9 8507	2313	.553 6353	12 6935	1563	.240 0773	5 5046	676
18	.822 8239	9 6168	2339	.540 9418	12 8467	1532	.234 5727	5 5707	661
19	.832 4407	9 3803	2365	.528 0951	12 9962	1495	.229 0020	5 6356	649
20	.841 8210	9 1410	2393	.515 0989	13 1427	1465	.223 3664	5 6988	632
21	-0.850 9620	- 8 8994	+2416	+0.501 9562	-13 2856	-1429	+0.217 6676	-5 7607	- 619
22	.859 8614	8 6551	2443	.488 6706	13 4252	1396	.211 9069	5 8212	605
23	.868 5165	8 4079	2472	.475 2454	13 5611	1359	.206 0857	5 8801	589
24	.876 9244	8 1583	2496	.461 6843	13 6939	1328	.200 2056	5 9375	574
25	.885 0827	7 9061	2522	.447 9904	13 8226	1287	.194 2681	5 9935	560
26	-0.892 9888	- 7 6512	+2549	+0.434 1678	-13 9481	-1255	+0.188 2746	-6 0478	- 543
27	.900 6400	7 3938	2574	.420 2197	14 0695	1214	.182 2268	6 1005	527
28	.908 0338	7 1339	2599	.406 1502	14 1873	1178	.176 1263	6 1517	512
29	.915 1677	6 8714	2625	.391 9629	14 3012	1139	.169 9746	6 2012	495
30	.922 0391	6 6067	2647	.377 6617	14 4111	1099	.163 7734	6 2489	477
Sept. 31	-0.928 6458	- 6 3392	+2675	+0.363 2506	-14 5171	-1060	+0.157 5245	-6 2951	- 462
1	.934 9850	6 0695	2697	.348 7335	14 6188	1017	.151 2294	6 3394	443
2	.941 0545	5 7975	2720	.334 1147	14 7162	974	.144 8900	6 3817	423
3	.946 8520	5 5232	2743	.319 3985	14 8094	932	.138 5083	6 4223	406
4	.952 3752	5 2469	2763	.304 5891	14 8977	883	.132 0860	6 4608	385
5	-0.957 6221	- 4 9687	+2782	+0.289 6914	-14 9816	- 839	+0.125 6252	-6 4973	- 365
6	.962 5908	4 6889	2798	.274 7098	15 0610	794	.119 1279	6 5317	344
7	.967 2797	4 4075	2814	.259 6488	15 1355	745	.112 5962	6 5641	324
8	.971 6872	4 1248	2827	.244 5133	15 2051	696	.106 0321	6 5943	302
9	.975 8120	3 8411	2837	.229 3082	15 2705	654	.099 4378	6 6225	282
10	-0.979 6531	- 3 5565	+2846	+0.214 0377	-15 3311	- 606	+0.092 8153	-6 6488	- 263
11	.983 2096	3 2709	2856	.198 7066	15 3872	561	.086 1665	6 6730	242
12	.986 4805	2 9845	2864	.183 3194	15 4388	516	.079 4935	6 6953	223
13	.989 4650	2 6976	2869	.167 8806	15 4862	474	.072 7982	6 7155	202
14	.992 1626	2 4100	2876	.152 3944	15 5292	430	.066 0827	6 7341	186
15	-0.994 5726	- 2 1215	+2885	+0.136 8652	-15 5680	- 388	+0.059 3486	-6 7507	- 166
16	.996 6941	1 8326	2889	.121 2972	15 6024	344	.052 5979	6 7655	148
17	0.998 5267	1 5431	2895	.105 6948	15 6326	302	.045 8324	6 7785	130
18	1.000 0698	1 2529	2902	.090 0622	15 6587	261	.039 0539	6 7897	112
19	1.001 3227	9621	2908	.074 4035	15 6803	216	.032 2642	6 7989	92
20	-1.002 2848	- 6709	+2912	+0.058 7232	-15 6978	- 175	+0.025 4653	-6 8066	- 77
21	1.002 9557	3790	2919	.043 0254	15 7109	131	.018 6587	6 8121	55
22	1.003 3347	867	2923	.027 3145	15 7196	87	.011 8466	6 8161	40
23	1.003 4214	2062	2929	+ .011 5949	15 7240	- 44	+ .005 0305	6 8179	18
24	1.003 2152	4993	2931	- .004 1291	15 7239	+ 1	- .001 7874	6 8180	- 1
25	-1.002 7159	- 7930	+2937	-0.019 8530	-15 7193	+ 46	-0.008 6054	-6 8161	+ 19
26	1.001 9229	1 0869	2939	.035 5723	15 7103	90	.015 4215	6 8123	38
27	1.000 8360	1 3810	2941	.051 2826	15 6965	138	.022 2338	6 8064	59
28	.999 4550	1 6755	2945	.066 9791	15 6783	182	.029 0402	6 7988	76
29	.997 7795	1 9698	2943	.082 6574	15 6552	231	.035 8390	6 7888	100
30	-0.995 8097	+ 2 2643	+2945	-0.098 3126	-15 6273	+ 279	-0.042 6278	-6 7770	+ 118
Oct. 1	-0.993 5454	+2945	+2945	-0.113 9399	+ 328	+ 328	-0.049 4048	+ 142	+ 142

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1967-0

Date		X		Y		Z	
Oct.	1	-0.993 5454	+ 2 5588 +2945	-0.113 9399	+ 328	-0.049 4048	+ 142
	2	.990 9866	+ 2 5588 2940	.129 5344	-15 5945 377	.056 1676	-6 7628 161
	3	.988 1338	+ 2 8528 2936	.145 0912	-15 5568 430	.062 9143	-6 7467 186
	4	.984 9874	+ 3 1464 2930	.160 6050	-15 5138 476	.069 6424	-6 7281 206
	5	.981 5480	+ 3 4394 2921	.176 0712	-15 4662 530	.076 3499	-6 7075 229
	6	-0.977 8165	+ 3 7315 +2908	-0.191 4844	+ 577	-0.083 0345	+ 252
	7	.973 7942	+ 4 0223 2895	.206 8399	-15 3555 628	.089 6939	-6 6594 272
	8	.969 4824	+ 4 3118 2882	.222 1326	-15 2927 672	.096 3261	-6 6322 293
	9	.964 8824	+ 4 6000 2864	.237 3581	-15 2255 721	.102 9290	-6 6029 315
	10	.959 9960	+ 4 8864 2850	.252 5115	-15 1534 766	.109 5004	-6 5714 333
	11	-0.954 8246	+ 5 1714 +2832	-0.267 5883	+ 808	-0.116 0385	+ 352
	12	.949 3700	+ 5 4546 2817	.282 5843	-14 9960 854	.122 5414	-6 5029 371
	13	.943 6337	+ 5 7363 2798	.297 4949	-14 9106 895	.129 0072	-6 4658 391
	14	.937 6176	+ 6 0161 2782	.312 3160	-14 8211 936	.135 4339	-6 4267 408
	15	.931 3233	+ 6 2943 2764	.327 0435	-14 7275 980	.141 8198	-6 3859 424
	16	-0.924 7526	+ 6 5707 +2748	-0.341 6730	+ 1021	-0.148 1633	+ 446
	17	.917 9071	+ 6 8455 2729	.356 2004	-14 5274 1063	.154 4622	-6 2989 460
	18	.910 7887	+ 7 1184 2711	.370 6215	-14 4211 1104	.160 7151	-6 2529 478
	19	.903 3992	+ 7 3895 2692	.384 9322	-14 3107 1146	.166 9202	-6 2051 498
	20	.895 7405	+ 7 6587 2673	.399 1283	-14 1961 1186	.173 0755	-6 1553 513
	21	-0.887 8145	+ 7 9260 +2654	-0.413 2058	+ 1229	-0.179 1795	+ 533
	22	.879 6231	+ 8 1914 2637	.427 1604	-13 9546 1270	.185 2302	-6 0507 550
	23	.871 1680	+ 8 4551 2612	.440 9880	-13 8276 1313	.191 2259	-5 9957 567
	24	.862 4517	+ 8 7163 2593	.454 6843	-13 6963 1352	.197 1649	-5 9390 586
	25	.853 4761	+ 8 9756 2573	.468 2454	-13 5611 1396	.203 0453	-5 8804 604
	26	-0.844 2432	+ 9 2329 +2550	-0.481 6669	+ 1438	-0.208 8653	+ 621
	27	.834 7553	+ 9 4879 2524	.494 9446	-13 2777 1480	.214 6232	-5 7579 640
	28	.825 0150	+ 9 7493 2503	.508 0743	-13 1297 1525	.220 3171	-5 6939 660
	29	.815 0244	+ 9 9906 2477	.521 0515	-12 9772 1566	.225 9450	-5 6279 678
	30	.804 7861	+ 10 2383 2448	.533 8721	-12 8206 1609	.231 5051	-5 5601 698
	31	-0.794 3030	+ 10 4831 +2421	-0.546 5318	+ 1656	-0.236 9954	+ 717
Nov.	1	.783 5778	+ 10 7252 2387	.559 0259	-12 4941 1698	.242 4140	-5 4186 735
	2	.772 6139	+ 10 9639 2356	.571 3502	-12 3243 1739	.247 7591	-5 3451 755
	3	.761 4144	+ 11 1995 2319	.583 5006	-12 1504 1781	.253 0287	-5 2696 771
	4	.749 9830	+ 11 4314 2283	.595 4729	-11 9723 1821	.258 2212	-5 1925 793
	5	-0.738 3233	+ 11 6597 +2243	-0.607 2631	+ 1860	-0.263 3344	+ 807
	6	.726 4393	+ 11 8840 2206	.618 8673	-11 6042 1895	.268 3669	-5 0325 824
	7	.714 3347	+ 12 1046 2166	.630 2820	-11 4147 1929	.273 3170	-4 9501 838
	8	.702 0135	+ 12 3212 2125	.641 5038	-11 2218 1966	.278 1833	-4 8663 854
	9	.689 4798	+ 12 5337 2089	.652 5290	-11 0252 1996	.282 9642	-4 7809 867
	10	-0.676 7372	+ 12 7426 +2048	-0.663 3546	+ 2028	-0.287 6584	+ 881
	11	.663 7898	+ 12 9474 2009	.673 9774	-10 6228 2059	.292 2645	-4 6061 893
	12	.650 6415	+ 13 1483 1970	.684 3943	-10 4169 2089	.296 7813	-4 5168 909
	13	.637 2962	+ 13 3453 1932	.694 6023	-10 2080 2120	.301 2072	-4 4259 918
	14	.623 7577	+ 13 5385 1890	.704 5983	-9 9960 2150	.305 5413	-4 3341 933
	15	-0.610 0302	+ 13 7275 +1852	-0.714 3793	+ 2175	-0.309 7821	+ 944
	16	-0.596 1175	+ 13 9127 +1814	-0.723 9428	+ 2208	-0.313 9285	+ 956

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
 MEAN EQUATOR AND EQUINOX OF 1967.0

Date	X			Y			Z		
Nov. 16	-0.596 1175	+14 0941	+1814	-0.723 9428	- 9 3427	+2208	-0.313 9285	-4 0508	+ 956
17	.582 0234	14 2713	1772	.733 2855	9 1192	2235	.317 9793	3 9538	970
18	.567 7521	14 4446	1733	.742 4047	8 8931	2261	.321 9331	3 8560	978
19	.553 3075	14 6139	1693	.751 2978	8 6641	2290	.325 7891	3 7567	993
20	.538 6936	14 7790	1651	.759 9619	8 4322	2319	.329 5458	3 6564	1003
21	-0.523 9146	+14 9401	+1611	-0.768 3941	- 8 1977	+2345	-0.333 2022	-3 5547	+1017
22	.508 9745	15 0970	1569	.776 5918	7 9606	2371	.336 7569	3 4521	1026
23	.493 8775	15 2497	1527	.784 5524	7 7206	2400	.340 2090	3 3483	1038
24	.478 6278	15 3981	1484	.792 2730	7 4780	2426	.343 5573	3 2431	1052
25	.463 2297	15 5421	1440	.799 7510	7 2326	2454	.346 8004	3 1368	1063
26	-0.447 6876	+15 6817	+1396	-0.806 9836	- 6 9846	+2480	-0.349 9372	-3 0295	+1073
27	.432 0059	15 8163	1346	.813 9682	6 7340	2506	.352 9667	2 9209	1086
28	.416 1896	15 9465	1302	.820 7022	6 4804	2536	.355 8876	2 8109	1100
29	.400 2431	16 0713	1248	.827 1826	6 2249	2555	.358 6985	2 7001	1108
30	.384 1718	16 1912	1199	.833 4075	5 9666	2583	.361 3986	2 5880	1121
Dec. 1	-0.367 9806	+16 3057	+1145	-0.839 3741	- 5 7063	+2603	-0.363 9866	-2 4751	+1129
2	.351 6749	16 4148	1091	.845 0804	5 4436	2627	.366 4617	2 3611	1140
3	.335 2601	16 5184	1036	.850 5240	5 1795	2641	.368 8228	2 2462	1149
4	.318 7417	16 6166	982	.855 7035	4 9134	2661	.371 0690	2 1309	1153
5	.302 1251	16 7092	926	.860 6169	4 6459	2675	.373 1999	2 0146	1163
6	-0.285 4159	+16 7963	+ 871	-0.865 2628	- 4 3773	+2686	-0.375 2145	-1 8979	+1167
7	.268 6196	16 8781	818	.869 6401	4 1073	2700	.377 1124	1 7809	1170
8	.251 7415	16 9546	765	.873 7474	3 8363	2710	.378 8933	1 6631	1178
9	.234 7869	17 0258	712	.877 5837	3 5644	2719	.380 5564	1 5452	1179
10	.217 7611	17 0918	660	.881 1481	3 2914	2730	.382 1016	1 4266	1186
11	-0.200 6693	+17 1525	+ 607	-0.884 4395	- 3 0176	+2738	-0.383 5282	-1 3080	+1186
12	.183 5168	17 2081	556	.887 4571	2 7430	2746	.384 8362	1 1888	1192
13	.166 3087	17 2586	505	.890 2001	2 4677	2753	.386 0250	1 0695	1193
14	.149 0501	17 3038	452	.892 6678	2 1917	2760	.387 0945	9498	1197
15	.131 7463	17 3440	402	.894 8595	1 9152	2765	.388 0443	8301	1197
16	-0.114 4023	+17 3790	+ 350	-0.896 7747	- 1 6380	+2772	-0.388 8744	- 7100	+1201
17	.097 0233	17 4090	300	.898 4127	1 3604	2776	.389 5844	5896	1204
18	.079 6143	17 4339	249	.899 7731	1 0823	2781	.390 1740	4693	1203
19	.062 1804	17 4537	198	.900 8554	8036	2787	.390 6433	3485	1208
20	.044 7267	17 4687	150	.901 6590	5247	2789	.390 9918	2278	1207
21	-0.027 2580	+17 4781	+ 94	-0.902 1837	- 2452	+2795	-0.391 2196	- 1067	+1211
22	.009 7799	17 4827	9	.902 4289	345	2797	.391 3263	145	1212
23	+ .007 7028	17 4818	- 9	.902 3944	3147	2802	.391 3118	1359	1214
24	.025 1846	17 4758	60	.902 0797	5952	2805	.391 1759	2574	1215
25	.042 6604	17 4642	116	.901 4845	8759	2807	.390 9185	3791	1217
26	+0.060 1246	+17 4471	- 171	-0.900 6086	+ 1 1568	+2809	-0.390 5394	+ 5009	+1218
27	.077 5717	17 4245	226	.899 4518	1 4375	2807	.390 0385	6227	1218
28	.094 9962	17 3959	286	.898 0143	1 7181	2806	.389 4158	7445	1218
29	.112 3921	17 3616	343	.896 2962	1 9986	2805	.388 6713	8661	1216
30	.129 7537	17 3216	400	.894 2976	2 2785	2799	.387 8052	9877	1216
31	+0.147 0753	+17 2754	- 462	-0.892 0191	+ 2 5576	+2791	-0.386 8175	+ 1 1089	+1212
32	+0.164 3507	- 516		-0.889 4615	+2784		-0.385 7086	+1209	

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
 MEAN EQUATOR AND EQUINOX OF 1950.0

Date		X_{1950}			Y_{1950}			Z_{1950}		
Jan.	0	+0.147 4020	+17 2632	-448	-0.891 9397	+2 5553	+2767	-0.386 7813	+1 1079	+1199
	1	.164 6652	17 2137	495	.889 3844	2 8315	2762	.385 6734	1 2275	1196
	2	.181 8789	17 1588	549	.886 5529	3 1072	2757	.384 4459	1 3468	1193
	3	.199 0377	17 0987	601	.883 4457	3 3822	2750	.383 0991	1 4660	1192
	4	.216 1364	17 0330	657	.880 0635	3 6566	2744	.381 6331	1 5850	1190
	5	+0.233 1694	+16 9619	-711	-0.876 4069	+3 9304	+2738	-0.380 0481	+1 7036	+1186
	6	.250 1313	16 8853	766	.872 4765	4 2030	2726	.378 3445	1 8218	1182
	7	.267 0166	16 8031	822	.868 2735	4 4744	2714	.376 5227	1 9396	1178
	8	.283 8197	16 7153	878	.863 7991	4 7448	2704	.374 5831	2 0569	1173
	9	.300 5350	16 6219	934	.859 0543	5 0135	2687	.372 5262	2 1736	1167
	10	+0.317 1569	+16 5229	-990	-0.854 0408	+5 2806	+2671	-0.370 3526	+2 2895	+1159
	11	.333 6798	16 4185	1044	.848 7602	5 5459	2653	.368 0631	2 4047	1152
	12	.350 0983	16 3086	1099	.843 2143	5 8094	2635	.365 6584	2 5191	1144
	13	.366 4069	16 1937	1149	.837 4049	6 0707	2613	.363 1393	2 6325	1134
	14	.382 6006	16 0732	1205	.831 3342	6 3297	2590	.360 5068	2 7450	1125
	15	+0.398 6738	+15 9479	-1253	-0.825 0045	+6 5867	+2570	-0.357 7618	+2 8566	+1116
	16	.414 6217	15 8175	1304	.818 4178	6 8411	2544	.354 9052	2 9671	1105
	17	.430 4392	15 6824	1351	.811 5767	7 0932	2521	.351 9381	3 0764	1093
	18	.446 1216	15 5424	1400	.804 4835	7 3427	2495	.348 8617	3 1846	1082
	19	.461 6640	15 3975	1449	.797 1408	7 5897	2470	.345 6771	3 2918	1072
	20	+0.477 0615	+15 2483	-1492	-0.789 5511	+7 8340	+2443	-0.342 3853	+3 3978	+1060
	21	.492 3098	15 0945	1538	.781 7171	8 0756	2416	.338 9875	3 5025	1047
	22	.507 4043	14 9363	1582	.773 6415	8 3144	2388	.335 4850	3 6059	1034
	23	.522 3406	14 7739	1624	.765 3271	8 5505	2361	.331 8791	3 7083	1024
	24	.537 1145	14 6075	1664	.756 7766	8 7837	2332	.328 1708	3 8093	1010
	25	+0.551 7220	+14 4368	-1707	-0.747 9929	+9 0143	+2306	-0.324 3615	+3 9091	+998
	26	.566 1588	14 2622	1746	.738 9786	9 2420	2277	.320 4524	4 0077	986
	27	.580 4210	14 0836	1786	.729 7366	9 4672	2252	.316 4447	4 1052	975
	28	.594 5046	13 9010	1826	.720 2694	9 6896	2224	.312 3395	4 2015	963
	29	.608 4056	13 7144	1866	.710 5798	9 9092	2196	.308 1380	4 2966	951
	30	+0.622 1200	+13 5236	-1908	-0.700 6706	+10 1263	+2171	-0.303 8414	+4 3905	+939
Feb.	31	.635 6436	13 3285	1951	.690 5443	10 3404	2141	.299 4509	4 4834	929
	1	.648 9721	13 1293	1992	.680 2039	10 5516	2112	.294 9675	4 5748	914
	2	.662 1014	12 9259	2034	.669 6523	10 7596	2080	.290 3927	4 6652	904
	3	.675 0273	12 7183	2076	.658 8927	10 9646	2050	.285 7275	4 7540	888
	4	+0.687 7456	+12 5064	-2119	-0.647 9281	+11 1663	+2017	-0.280 9735	+4 8415	+875
	5	.700 2520	12 2904	2160	.636 7618	11 3641	1978	.276 1320	4 9275	860
	6	.712 5424	12 0704	2200	.625 3977	11 5587	1946	.271 2045	5 0119	844
	7	.724 6128	11 8463	2241	.613 8390	11 7493	1906	.266 1926	5 0948	829
	8	.736 4591	11 6185	2278	.602 0897	11 9360	1867	.261 0978	5 1759	811
	9	+0.748 0776	+11 3870	-2315	-0.590 1537	+12 1190	+1830	-0.255 9219	+5 2553	+794
	10	.759 4646	11 1517	2353	.578 0347	12 2975	1785	.250 6666	5 3330	777
	11	.770 6163	10 9132	2385	.565 7372	12 4721	1746	.245 3336	5 4088	758
	12	.781 5295	10 6713	2419	.553 2651	12 6426	1705	.239 9248	5 4827	739
	13	.792 2008	10 4263	2450	.540 6225	12 8086	1660	.234 4421	5 5549	722
	14	+0.802 6271	+10 1783	-2480	-0.527 8139	+12 9705	+1619	-0.228 8872	+5 6251	+702
	15	+0.812 8054	+10 0000	-2510	-0.514 8434	+13 1350	+1575	-0.223 2621	+5 6950	+684

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
 MEAN EQUATOR AND EQUINOX OF 1950-0

Date	X_{1950}			Y_{1950}			Z_{1950}		
Feb. 15	+0.812 8054	+ 9 9273	-2510	-0.514 8434	+13 1280	+1575	-0.223 2621	+5 6935	+ 684
16	.822 7327	9 6736	2537	.501 7154	13 2811	1531	.217 5686	5 7599	664
17	.832 4063	9 4173	2563	.488 4343	13 4298	1487	.211 8087	5 8243	644
18	.841 8236	9 1585	2588	.475 0045	13 5742	1444	.205 9844	5 8869	626
19	.850 9821	8 8974	2611	.461 4303	13 7142	1400	.200 0975	5 9475	606
20	+0.859 8795	+ 8 6341	-2633	-0.447 7161	+13 8498	+1356	-0.194 1500	+6 0061	+ 586
21	.868 5136	8 3686	2655	.433 8663	13 9809	1311	.188 1439	6 0630	569
22	.876 8822	8 1014	2672	.419 8854	14 1080	1271	.182 0809	6 1178	548
23	.884 9836	7 8321	2693	.405 7774	14 2308	1228	.175 9631	6 1709	531
24	.892 8157	7 5610	2711	.391 5466	14 3494	1186	.169 7922	6 2222	513
25	+0.900 3767	+ 7 2880	-2730	-0.377 1972	+14 4640	+1146	-0.163 5700	+6 2718	+ 496
26	.907 6647	7 0131	2749	.362 7332	14 5745	1105	.157 2982	6 3196	478
27	.914 6778	6 7361	2770	.348 1587	14 6809	1064	.150 9786	6 3655	459
28	.921 4139	6 4573	2788	.333 4778	14 7831	1022	.144 6131	6 4099	444
Mar. 1	.927 8712	6 1764	2809	.318 6947	14 8811	980	.138 2032	6 4523	424
2	+0.934 0476	+ 5 8935	-2829	-0.303 8136	+14 9748	+ 937	-0.131 7509	+6 4930	+ 407
3	.939 9411	5 6085	2850	.288 8388	15 0638	890	.125 2579	6 5317	387
4	.945 5496	5 3219	2866	.273 7750	15 1485	847	.118 7262	6 5685	368
5	.950 8715	5 0334	2885	.258 6265	15 2284	799	.112 1577	6 6033	348
6	.955 9049	4 7432	2902	.243 3981	15 3034	750	.105 5544	6 6360	327
7	+0.960 6481	+ 4 4515	-2917	-0.228 0947	+15 3737	+ 703	-0.098 9184	+6 6666	+ 306
8	.965 0996	4 1585	2930	.212 7210	15 4392	655	.092 2518	6 6951	285
9	.969 2581	3 8641	2944	.197 2818	15 4995	603	.085 5567	6 7215	264
10	.973 1222	3 5688	2953	.181 7823	15 5549	554	.078 8352	6 7456	241
11	.976 6910	3 2726	2962	.166 2274	15 6054	505	.072 0896	6 7676	220
12	+0.979 9636	+ 2 9753	-2973	-0.150 6220	+15 6508	+ 454	-0.065 3220	+6 7874	+ 198
13	.982 9389	2 6778	2975	.134 9712	15 6912	404	.058 5346	6 8050	176
14	.985 6167	2 3796	2982	.119 2800	15 7266	354	.051 7296	6 8204	154
15	.987 9963	2 0811	2985	.103 5534	15 7570	304	.044 9092	6 8336	132
16	.990 0774	1 7823	2988	.087 7964	15 7824	254	.038 0756	6 8445	109
17	+0.991 8597	+ 1 4836	-2987	-0.072 0140	+15 8029	+ 205	-0.031 2311	+6 8534	+ 89
18	.993 3433	1 1849	2987	.056 2111	15 8185	156	.024 3777	6 8601	67
19	.994 5282	8863	2986	.040 3926	15 8291	106	.017 5176	6 8646	45
20	.995 4145	5883	2980	.024 5635	15 8350	59	.010 6530	6 8669	23
21	.996 0028	2906	2977	-.008 7285	15 8362	+ 12	-.003 7861	6 8673	+ 4
22	+0.996 2934	+ 65	-2971	+0.007 1077	+15 8328	- 34	+0.003 0812	+6 8657	- 16
23	.996 2869	3029	2964	.022 9405	15 8249	79	.009 9469	6 8621	36
24	.995 9840	5988	2959	.038 7654	15 8127	122	.016 8090	6 8566	55
25	.995 3852	8941	2953	.054 5781	15 7960	167	.023 6656	6 8493	73
26	.994 4911	1 1888	2947	.070 3741	15 7752	208	.030 5149	6 8401	92
27	+0.993 3023	+ 1 4829	-2941	+0.086 1493	+15 7500	- 252	+0.037 3550	+6 8292	- 109
28	.991 8194	1 7766	2937	.101 8993	15 7206	294	.044 1842	6 8164	128
29	.990 0428	2 0698	2932	.117 6199	15 6869	337	.051 0006	6 8018	146
30	.987 9730	2 3626	2928	.133 3068	15 6486	383	.057 8024	6 7852	166
31	.985 6104	2 6546	2920	.148 9554	15 6060	426	.064 5876	6 7669	183
Apr. 1	+0.982 9558	+ 2 9463	-2917	+0.164 5614	+15 5586	- 474	+0.071 3545	+6 7465	- 204
2	+0.980 0095	- 2908	-2908	+0.180 1200	- 520	- 520	+0.078 1010	- 224	- 224

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1950.0

Date	X_{1950}			Y_{1950}			Z_{1950}		
Apr. 1	+0.982 9558	- 2 9463	-2917	+0.164 5614	+15 5586	- 474	+0.071 3545	+6 7465	- 204
2	.980 0095	3 2371	2908	.180 1200	15 5066	520	.078 1010	6 7241	224
3	.976 7724	3 5270	2899	.195 6266	15 4500	566	.084 8251	6 6996	245
4	.973 2454	3 8158	2888	.211 0766	15 3886	614	.091 5247	6 6733	263
5	.969 4296	4 1036	2878	.226 4652	15 3225	661	.098 1980	6 6446	287
6	+0.965 3260	- 4 3901	-2865	+0.241 7877	+15 2516	- 709	+0.104 8426	+6 6142	- 304
7	.960 9359	4 6750	2849	.257 0393	15 1761	755	.111 4568	6 5814	328
8	.956 2609	4 9583	2833	.272 2154	15 0960	801	.118 0382	6 5469	345
9	.951 3026	5 2401	2818	.287 3114	15 0111	849	.124 5851	6 5100	369
10	.946 0625	5 5198	2797	.302 3225	14 9216	895	.131 0951	6 4714	386
11	+0.940 5427	- 5 7976	-2778	+0.317 2441	+14 8277	- 939	+0.137 5665	+6 4306	- 408
12	.934 7451	6 0734	2758	.332 0718	14 7291	986	.143 9971	6 3879	427
13	.928 6717	6 3469	2735	.346 8009	14 6263	1028	.150 3850	6 3432	447
14	.922 3248	6 6180	2711	.361 4272	14 5190	1073	.156 7282	6 2967	465
15	.915 7068	6 8867	2687	.375 9462	14 4073	1117	.163 0249	6 2480	487
16	+0.908 8201	- 7 1527	-2660	+0.390 3535	+14 2917	-1156	+0.169 2729	+6 1978	- 502
17	.901 6674	7 4161	2634	.404 6452	14 1719	1198	.175 4707	6 1457	521
18	.894 2513	7 6767	2606	.418 8171	14 0481	1238	.181 6164	6 0919	538
19	.886 5746	7 9346	2579	.432 8652	13 9205	1276	.187 7083	6 0363	556
20	.878 6400	8 1894	2548	.446 7857	13 7893	1312	.193 7446	5 9793	570
21	+0.870 4506	- 8 4416	-2522	+0.460 5750	+13 6545	-1348	+0.199 7239	+5 9207	- 586
22	.862 0090	8 6910	2494	.474 2295	13 5162	1383	.205 6446	5 8606	601
23	.853 3180	8 9376	2466	.487 7457	13 3746	1416	.211 5052	5 7990	616
24	.844 3804	9 1816	2440	.501 1203	13 2295	1451	.217 3042	5 7362	628
25	.835 1988	9 4231	2415	.514 3498	13 0811	1484	.223 0404	5 6719	643
26	+0.825 7757	- 9 6618	-2387	+0.527 4309	+12 9293	-1518	+0.228 7123	+5 6059	- 660
27	.816 1139	9 8982	2364	.540 3602	12 7740	1553	.234 3182	5 5388	671
28	.806 2157	10 1318	2336	.553 1342	12 6150	1590	.239 8570	5 4701	687
29	.796 0839	10 3627	2309	.565 7492	12 4527	1623	.245 3271	5 3997	704
30	.785 7212	10 5909	2282	.578 2019	12 2865	1662	.250 7268	5 3278	719
May 1	+0.775 1303	-10 8161	-2252	+0.590 4884	+12 1168	-1697	+0.256 0546	+5 2544	- 734
2	.764 3142	11 0382	2221	.602 6052	11 9435	1733	.261 3090	5 1795	749
3	.753 2760	11 2571	2189	.614 5487	11 7665	1770	.266 4885	5 1028	767
4	.742 0189	11 4728	2157	.626 3152	11 5863	1802	.271 5913	5 0248	780
5	.730 5461	11 6849	2121	.637 9015	11 4023	1840	.276 6161	4 9451	797
6	+0.718 8612	-11 8936	-2087	+0.649 3038	+11 2150	-1873	+0.281 5612	+4 8640	- 811
7	.706 9676	12 0986	2050	.660 5188	11 0244	1906	.286 4252	4 7814	826
8	.694 8690	12 2999	2013	.671 5432	10 8304	1940	.291 2066	4 6972	842
9	.682 5691	12 4975	1976	.682 3736	10 6332	1972	.295 9038	4 6118	854
10	.670 0716	12 6910	1935	.693 0068	10 4330	2002	.300 5156	4 5249	869
11	+0.657 3806	-12 8804	-1894	+0.703 4398	+10 2297	-2033	+0.305 0405	+4 4366	- 883
12	.644 5002	13 0658	1854	.713 6695	10 0235	2062	.309 4771	4 3472	894
13	.631 4344	13 2469	1811	.723 6930	9 8145	2090	.313 8243	4 2563	909
14	.618 1875	13 4238	1769	.733 5075	9 6027	2118	.318 0806	4 1644	919
15	.604 7637	13 5963	1725	.743 1102	9 3887	2140	.322 2450	4 0714	930
16	+0.591 1674	-13 7646	-1683	+0.752 4989	+9 1719	-2168	+0.326 3164	+3 9772	- 942
17	+0.577 4028	-1638	+0.761 6708	-2187	+0.330 2936	- 949			

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1950-0

Date	X_{1950}			Y_{1950}			Z_{1950}		
May 17	+0.577 4028	-13 9284	-1638	+0.761 6708	+ 8 9532	-2187	+0.330 2936	+3 8823	- 949
18	.563 4744	14 0878	1594	.770 6240	8 7322	2210	.334 1759	3 7862	961
19	.549 3866	14 2432	1554	.779 3562	8 5093	2229	.337 9621	3 6894	968
20	.535 1434	14 3942	1510	.787 8655	8 2844	2249	.341 6515	3 5918	976
21	.520 7492	14 5411	1469	.796 1499	8 0577	2267	.345 2433	3 4935	983
22	+0.506 2081	-14 6840	-1429	+0.804 2076	+ 7 8293	-2284	+0.348 7368	+3 3944	- 991
23	.491 5241	14 8230	1390	.812 0369	7 5989	2304	.352 1312	3 2946	998
24	.476 7011	14 9581	1351	.819 6358	7 3668	2321	.355 4258	3 1940	1006
25	.461 7430	15 0893	1312	.827 0026	7 1328	2340	.358 6198	3 0926	1014
26	.446 6537	15 2163	1270	.834 1354	6 8969	2359	.361 7124	2 9905	1021
27	+0.431 4374	-15 3398	-1235	+0.841 0323	+ 6 6591	-2378	+0.364 7029	+2 8875	-1030
28	.416 0976	15 4588	1190	.847 6914	6 4192	2399	.367 5904	2 7837	1038
29	.400 6388	15 5739	1151	.854 1106	6 1775	2417	.370 3741	2 6790	1047
30	.385 0649	15 6846	1107	.860 2881	5 9338	2437	.373 0531	2 5735	1055
31	.369 3803	15 7908	1062	.866 2219	5 6883	2455	.375 6266	2 4671	1064
June 1	+0.353 5895	-15 8927	-1019	+0.871 9102	+ 5 4410	-2473	+0.378 0937	+2 3601	-1070
2	.337 6968	15 9899	972	.877 3512	5 1922	2488	.380 4538	2 2522	1079
3	.321 7069	16 0826	927	.882 5434	4 9415	2507	.382 7060	2 1435	1087
4	.305 6243	16 1705	879	.887 4849	4 6894	2521	.384 8495	2 0343	1092
5	.289 4538	16 2537	832	.892 1743	4 4359	2535	.386 8838	1 9243	1100
6	+0.273 2001	-16 3320	- 783	+0.896 6102	+ 4 1809	-2550	+0.388 8081	+1 8137	-1106
7	.256 8681	16 4056	736	.900 7911	3 9247	2562	.390 6218	1 7026	1111
8	.240 4625	16 4741	685	.904 7158	3 6673	2574	.392 3244	1 5909	1117
9	.223 9884	16 5374	633	.908 3831	3 4089	2584	.393 9153	1 4787	1122
10	.207 4510	16 5959	585	.911 7920	3 1498	2591	.395 3940	1 3662	1125
11	+0.190 8551	-16 6492	- 533	+0.914 9418	+ 2 8898	-2600	+0.396 7602	+1 2532	-1130
12	.174 2059	16 6974	482	.917 8316	2 6292	2606	.398 0134	1 1401	1131
13	.157 5085	16 7407	433	.920 4608	2 3682	2610	.399 1535	1 0267	1134
14	.140 7678	16 7788	381	.922 8290	2 1069	2613	.400 1802	9134	1133
15	.123 9890	16 8123	335	.924 9359	1 8456	2613	.401 0936	7997	1137
16	+0.107 1767	-16 8406	- 283	+0.926 7815	+ 1 5839	-2617	+0.401 8933	+ 6863	-1134
17	.090 3361	16 8645	239	.928 3654	1 3224	2615	.402 5796	5728	1135
18	.073 4716	16 8836	191	.929 6878	1 0609	2615	.403 1524	4594	1134
19	.056 5880	16 8983	147	.930 7487	7995	2614	.403 6118	3460	1134
20	.039 6897	16 9086	103	.931 5482	5380	2615	.403 9578	2328	1132
21	+0.022 7811	-16 9144	- 58	+0.932 0862	+ 2769	-2611	+0.404 1906	+ 1195	-1133
22	+ .005 8667	16 9161	- 17	.932 3631	154	2615	.404 3101	64	1131
23	- .011 0494	16 9132	+ 29	.932 3785	2458	2612	.404 3165	1067	1131
24	.027 9626	16 9061	71	.932 1327	5971	2613	.404 2098	2199	1132
25	.044 8687	16 8944	117	.931 6256	7686	2615	.403 9899	3332	1133
26	-0.061 7631	-16 8782	+ 162	+0.930 8570	- 1 0299	-2613	+0.403 6567	- 4463	-1131
27	.078 6413	16 8576	206	.929 8271	1 2913	2614	.403 2104	5595	1132
28	.095 4989	16 8321	255	.928 5358	1 5525	2612	.402 6509	6727	1132
29	.112 3310	16 8019	302	.926 9833	1 8137	2612	.401 9782	7858	1131
30	.129 1329	16 7670	349	.925 1696	2 0744	2607	.401 1924	8989	1131
July 1	-0.145 8999	-16 7273	+ 397	+0.923 0952	- 2 3349	-2605	+0.400 2935	-1 0118	-1129
2	-0.162 6272		+ 445	+0.920 7603		-2599	+0.399 2817		-1127

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
 MEAN EQUATOR AND EQUINOX OF 1950-0

Date		X_{1950}			Y_{1950}			Z_{1950}		
July	1	-0.145 8999	-16 7273	+ 397	+0.923 0952	- 2 3349	-2605	+0.400 2935	-1 0118	-1129
	2	.162 6272	16 6828	445	.920 7603	2 5948	2599	.399 2817	1 1245	1127
	3	.179 3100	16 6333	495	.918 1655	2 8543	2595	.398 1572	1 2370	1125
	4	.195 9433	16 5790	543	.915 3112	3 1132	2589	.396 9202	1 3494	1124
	5	.212 5223	16 5197	593	.912 1980	3 3713	2581	.395 5708	1 4613	1119
	6	-0.229 0420	-16 4555	+ 642	+0.908 8267	- 3 6285	-2572	+0.394 1095	-1 5731	-1118
	7	.245 4975	16 3862	693	.905 1982	3 8849	2564	.392 5364	1 6843	1112
	8	.261 8837	16 3119	743	.901 3133	4 1400	2551	.390 8521	1 7952	1109
	9	.278 1956	16 2326	793	.897 1733	4 3939	2539	.389 0569	1 9054	1102
	10	.294 4282	16 1486	840	.892 7794	4 6463	2524	.387 1515	2 0149	1095
	11	-0.310 5768	-16 0595	+ 891	+0.888 1331	- 4 8972	-2509	+0.385 1366	-2 1240	-1091
	12	.326 6363	15 9659	936	.883 2359	5 1463	2491	.383 0126	2 2321	1081
	13	.342 6022	15 8675	984	.878 0896	5 3936	2473	.380 7805	2 3395	1074
	14	.358 4697	15 7651	1024	.872 6960	5 6391	2455	.378 4410	2 4460	1065
	15	.374 2348	15 6578	1073	.867 0569	5 8827	2436	.375 9950	2 5517	1057
	16	-0.389 8926	-15 5467	+1111	+0.861 1742	- 6 1243	-2416	+0.373 4433	-2 6564	-1047
	17	.405 4393	15 4314	1153	.855 0499	6 3641	2398	.370 7869	2 7603	1039
	18	.420 8707	15 3121	1193	.848 6858	6 6019	2378	.368 0266	2 8634	1031
	19	.436 1828	15 1889	1232	.842 0839	6 8378	2359	.365 1632	2 9654	1020
	20	.451 3717	15 0617	1272	.835 2461	7 0719	2341	.362 1978	3 0669	1015
	21	-0.466 4334	-14 9307	+1310	+0.828 1742	- 7 3040	-2321	+0.359 1309	-3 1674	-1005
	22	.481 3641	14 7958	1349	.820 8702	7 5345	2305	.355 9635	3 2671	997
	23	.496 1599	14 6569	1389	.813 3357	7 7630	2285	.352 6964	3 3661	990
	24	.510 8168	14 5141	1428	.805 5727	7 9898	2268	.349 3303	3 4643	982
	25	.525 3309	14 3673	1468	.797 5829	8 2145	2247	.345 8660	3 5616	973
	26	-0.539 6982	-14 2163	+1510	+0.789 3684	- 8 4374	-2229	+0.342 3044	-3 6583	- 967
	27	.553 9145	14 0612	1551	.780 9310	8 6582	2208	.338 6461	3 7538	955
	28	.567 9757	13 9022	1590	.772 2728	8 8768	2186	.334 8923	3 8487	949
	29	.581 8779	13 7389	1633	.763 3960	9 0933	2165	.331 0436	3 9426	939
	30	.595 6168	13 5717	1672	.754 3027	9 3076	2143	.327 1010	4 0354	928
Aug.	31	-0.609 1885	-13 4003	+1714	+0.744 9951	- 9 5192	-2116	+0.323 0656	-4 1274	- 920
	1	.622 5888	13 2247	1756	.735 4759	9 7287	2095	.318 9382	4 2181	907
	2	.635 8135	13 0451	1796	.725 7472	9 9355	2068	.314 7201	4 3081	900
	3	.648 8586	12 8613	1838	.715 8117	10 1396	2041	.310 4120	4 3966	885
	4	.661 7199	12 6735	1878	.705 6721	10 3410	2014	.306 0154	4 4842	876
	5	-0.674 3934	-12 4816	+1919	+0.695 3311	-10 5393	-1983	+0.301 5312	-4 5703	- 861
	6	.686 8750	12 2857	1959	.684 7918	10 7347	1954	.296 9609	4 6552	849
	7	.699 1607	12 0859	1998	.674 0571	10 9267	1920	.292 3057	4 7386	834
	8	.711 2466	11 8824	2035	.663 1304	11 1154	1887	.287 5671	4 8206	820
	9	.723 1290	11 6752	2072	.652 0150	11 3006	1852	.282 7465	4 9010	804
	10	-0.734 8042	-11 4649	+2103	+0.640 7144	-11 4823	-1817	+0.277 8455	-4 9798	- 788
	11	.746 2691	11 2511	2138	.629 2321	11 6606	1783	.272 8657	5 0572	774
	12	.757 5202	11 0342	2169	.617 5715	11 8351	1745	.267 8085	5 1329	757
	13	.768 5544	10 8145	2197	.605 7364	12 0063	1712	.262 6756	5 2070	741
	14	.779 3689	10 5920	2225	.593 7301	12 1738	1675	.257 4686	5 2796	726
	15	-0.789 9609	-10 3666	+2254	+0.581 5563	-12 3380	-1642	+0.252 1890	-5 3507	- 711
	16	-0.800 3275	-10 1400	+2280	+0.569 2183	-12 5000	-1607	+0.246 8383	-5 4210	- 695

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1950-0

Date	X_{1950}			Y_{1950}			Z_{1950}		
Aug. 16	-0.800	3275	+2280	+0.569	2183	-1607	+0.246	8383	-695
17	.810	4661	-10 1386	.556	7196	-12 4987	.241	4181	-5 4202
18	.820	3741	9 9080	.544	0636	12 6560	.235	9299	5 4882
19	.830	0487	9 6746	.531	2536	12 8100	.230	3750	5 5549
20	.839	4876	9 4389	.518	2931	12 9605	.224	7551	5 6199
			9 2004			13 1079			5 6838
21	-0.848	6880	+2411	+0.505	1852	-1438	+0.219	0713	-622
22	.857	6473	-8 9593	.491	9335	-13 2517	.213	3253	-5 7460
23	.866	3628	8 7155	.478	5414	13 3921	.207	5185	5 8068
24	.874	8320	8 4692	.465	0123	13 5291	.201	6524	5 8661
25	.883	0521	8 2201	.451	3495	13 6628	.195	7284	5 9240
			7 9684			13 7925			5 9803
26	-0.891	0205	+2543	+0.437	5570	-1263	+0.189	7481	-548
27	.898	7346	-7 7141	.423	6382	-13 9188	.183	7130	-6 0351
28	.906	1919	7 4573	.409	5969	14 0413	.177	6247	6 0883
29	.913	3898	7 1979	.395	4368	14 1601	.171	4848	6 1399
30	.920	3258	6 9360	.381	1618	14 2750	.165	2950	6 1898
			6 6716			14 3858			6 2380
31	-0.926	9974	+2669	+0.366	7760	-1071	+0.159	0570	-465
Sept. 1	.933	4021	-6 4047	.352	2831	-14 4929	.152	7725	-6 2845
2	.939	5377	6 1356	.337	6875	14 5956	.146	4432	6 3293
3	.945	4015	5 8638	.322	9934	14 6941	.140	0711	6 3721
4	.950	9915	5 5900	.308	2052	14 7882	.133	6580	6 4131
			5 3141			14 8777			6 4521
5	-0.956	3056	+2778	+0.293	3275	-849	+0.127	2059	-369
6	.961	3419	-5 0363	.278	3649	-14 9626	.120	7169	-6 4890
7	.966	0988	4 7569	.263	3218	15 0431	.114	1930	6 5239
8	.970	5746	4 4758	.248	2033	15 1185	.107	6362	6 5568
9	.974	7681	4 1935	.233	0139	15 1894	.101	0488	6 5874
			3 9100			15 2557			6 6162
10	-0.978	6781	+2843	+0.217	7582	-618	+0.094	4326	-266
11	.982	3038	-3 6257	.202	4407	-15 3175	.087	7898	-6 6428
12	.985	6441	3 3403	.187	0661	15 3746	.081	1223	6 6675
13	.988	6984	3 0543	.171	6387	15 4274	.074	4320	6 6903
14	.991	4659	2 7675	.156	1629	15 4758	.067	7209	6 7111
			2 4800			15 5200			6 7300
15	-0.993	9459	+2881	+0.140	6429	-397	+0.060	9909	-171
16	0.996	1378	-2 1919	.125	0832	-15 5597	.054	2438	-6 7471
17	0.998	0409	1 9031	.109	4879	15 5953	.047	4814	6 7624
18	0.999	6545	1 6136	.093	8613	15 6266	.040	7055	6 7759
19	1.000	9781	1 3236	.078	2075	15 6538	.033	9180	6 7875
			1 0330			15 6766			6 7974
20	-1.002	0111	+2913	+0.062	5309	-184	+0.027	1206	-80
21	1.002	7528	-7417	.046	8359	-15 6950	.020	3152	-6 8054
22	1.003	2027	4499	.031	1265	15 7094	.013	5037	6 8115
23	1.003	3604	-1577	.015	4074	15 7191	.006	6879	6 8158
24	1.003	2253	+1351	-0.000	3173	15 7247	-0.000	1303	6 8182
			4284			15 7256			6 8187
25	-1.002	7969	+2936	-0.016	0429	+33	-0.006	9490	+13
26	1.002	0749	-7220	.031	7652	-15 7223	.013	7664	-6 8174
27	1.001	0590	1 0159	.047	4794	15 7142	.020	5804	6 8140
28	0.999	7489	1 3101	.063	1810	15 7016	.027	3891	6 8087
29	0.998	1442	1 6047	.078	8655	15 6845	.034	1905	6 8014
			1 8991			15 6625			6 7921
30	-0.996	2451	+2947	-0.094	5280	+268	-0.040	9826	+115
Oct. 1	-0.994	0513	+21938	-0.110	1637	-15 6357	-0.047	7632	-6 7806
			+2944			+315			+136

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
 MEAN EQUATOR AND EQUINOX OF 1950-0

Date		X_{1950}		Y_{1950}		Z_{1950}	
Oct.	1	-0.994 0513	+ 2 4882 +2944	-0.110 1637	-15 6042 + 315	-0.047 7632	-6 7670 + 136
	2	.991 5631	2 7826 2944	.125 7679	15 5675 367	.054 5302	6 7513 157
	3	.988 7805	3 0763 2937	.141 3354	15 5257 418	.061 2815	6 7333 180
	4	.985 7042	3 3696 2933	.156 8611	15 4790 467	.068 0148	6 7131 202
	5	.982 3346	3 6617 2921	.172 3401	15 4274 516	.074 7279	6 6907 224
	6	-0.978 6729	+ 3 9530 +2913	-0.187 7675	-15 3706 + 568	-0.081 4186	-6 6660 + 247
	7	.974 7199	4 2427 2897	.203 1381	15 3090 616	.088 0846	6 6392 268
	8	.970 4772	4 5312 2885	.218 4471	15 2428 662	.094 7238	6 6104 288
	9	.965 9460	4 8180 2868	.233 6899	15 1717 711	.101 3342	6 5795 309
	10	.961 1280	5 1032 2852	.248 8616	15 0964 753	.107 9137	6 5466 329
	11	-0.956 0248	+ 5 3869 +2837	-0.263 9580	-15 0165 + 799	-0.114 4603	-6 5119 + 347
	12	.950 6379	5 6688 2819	.278 9745	14 9324 841	.120 9722	6 4751 368
	13	.944 9691	5 9492 2804	.293 9069	14 8439 885	.127 4473	6 4366 385
	14	.939 0199	6 2278 2786	.308 7508	14 7512 927	.133 8839	6 3964 402
	15	.932 7921	6 5046 2768	.323 5020	14 6544 968	.140 2803	6 3542 422
	16	-0.926 2875	+ 6 7798 +2752	-0.338 1564	-14 5532 +1012	-0.146 6345	-6 3102 + 440
	17	.919 5077	7 0532 2734	.352 7096	14 4480 1052	.152 9447	6 2646 456
	18	.912 4545	7 3247 2715	.367 1576	14 3387 1093	.159 2093	6 2173 473
	19	.905 1298	7 5946 2699	.381 4963	14 2252 1135	.165 4266	6 1679 494
	20	.897 5352	7 8624 2678	.395 7215	14 1074 1178	.171 5945	6 1169 510
	21	-0.889 6728	+ 8 1283 +2659	-0.409 8289	-13 9855 +1219	-0.177 7114	-6 0642 + 527
	22	.881 5445	8 3925 2642	.423 8144	13 8596 1259	.183 7756	6 0097 545
	23	.873 1520	8 6544 2619	.437 6740	13 7295 1301	.189 7853	5 9533 564
	24	.864 4976	8 9143 2599	.451 4035	13 5950 1345	.195 7386	5 8952 581
	25	.855 5833	9 1722 2579	.464 9985	13 4564 1386	.201 6338	5 8352 600
	26	-0.846 4111	+ 9 4278 +2556	-0.478 4549	-13 3137 +1427	-0.207 4690	-5 7735 + 617
	27	.836 9833	9 6810 2532	.491 7686	13 1666 1471	.213 2425	5 7099 636
	28	.827 3023	9 9319 2509	.504 9352	13 0151 1515	.218 9524	5 6443 656
	29	.817 3704	10 1803 2484	.517 9503	12 8594 1557	.224 5967	5 5770 673
	30	.807 1901	10 4259 2456	.530 8097	12 6993 1601	.230 1737	5 5076 694
Nov.	31	-0.796 7642	+10 6686 +2427	-0.543 5090	-12 5347 +1646	-0.235 6813	-5 4363 + 713
	1	.786 0956	10 9082 2396	.556 0437	12 3659 1688	.241 1176	5 3632 731
	2	.775 1874	11 1445 2363	.568 4096	12 1929 1730	.246 4808	5 2881 751
	3	.764 0429	11 3773 2328	.580 6025	12 0156 1773	.251 7689	5 2112 769
	4	.752 6656	11 6063 2290	.592 6181	11 8344 1812	.256 9801	5 1324 788
	5	-0.741 0593	+11 8315 +2252	-0.604 4525	-11 6493 +1851	-0.262 1125	-5 0521 + 803
	6	.729 2278	12 0529 2214	.616 1018	11 4606 1887	.267 1646	4 9701 820
	7	.717 1749	12 2704 2175	.627 5624	11 2684 1922	.272 1347	4 8866 835
	8	.704 9045	12 4840 2136	.638 8308	11 0728 1956	.277 0213	4 8016 850
	9	.692 4205	12 6935 2095	.649 9036	10 8740 1988	.281 8229	4 7152 864
	10	-0.679 7270	+12 8993 +2058	-0.660 7776	-10 6719 +2021	-0.286 5381	-4 6274 + 878
	11	.666 8277	13 1011 2018	.671 4495	10 4668 2051	.291 1655	4 5385 889
	12	.653 7266	13 2991 1980	.681 9163	10 2585 2083	.295 7040	4 4479 906
	13	.640 4275	13 4932 1941	.692 1748	10 0473 2112	.300 1519	4 3564 915
	14	.626 9343	13 6833 1901	.702 2221	9 8332 2141	.304 5083	4 2635 929
	15	-0.613 2510	+13 8695 +1862	-0.712 0553	-9 6162 +2170	-0.308 7718	-4 1693 + 942
	16	-0.599 3815	+1822	-0.721 6715	+2200	-0.312 9411	+ 953

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
 MEAN EQUATOR AND EQUINOX OF 1950.0

Date	X_{1950}	Y_{1950}	Z_{1950}
Nov. 16	-0.599 3815 +14 0517 +1822	-0.721 6715 - 9 3962 +2200	-0.312 9411 -4 0740 + 953
17	.585 3298 14 2300 1783	.731 0677 9 1734 2228	.317 0151 3 9775 965
18	.571 0998 14 4043 1743	.740 2411 8 9479 2255	.320 9926 3 8797 978
19	.556 6955 14 5746 1703	.749 1890 8 7195 2284	.324 8723 3 7808 989
20	.542 1209 14 7408 1662	.757 9085 8 4883 2312	.328 6531 3 6807 1001
21	-0.527 3801 +14 9030 +1622	-0.766 3968 - 8 2544 +2339	-0.332 3338 -3 5795 +1012
22	.512 4771 15 0609 1579	.774 6512 8 0179 2365	.335 9133 3 4770 1025
23	.497 4162 15 2147 1538	.782 6691 7 7785 2394	.339 3903 3 3734 1036
24	.482 2015 15 3642 1495	.790 4476 7 5364 2421	.342 7637 3 2685 1049
25	.466 8373 15 5094 1452	.797 9840 7 2916 2448	.346 0322 3 1626 1059
26	-0.451 3279 +15 6499 +1405	-0.805 2756 - 7 0441 +2475	-0.349 1948 -3 0553 +1073
27	.435 6780 15 7858 1359	.812 3197 6 7940 2501	.352 2501 2 9469 1084
28	.419 8922 15 9171 1313	.819 1137 6 5411 2529	.355 1970 2 8373 1096
29	.403 9751 16 0430 1259	.825 6548 6 2858 2553	.358 0343 2 7266 1107
30	.387 9321 16 1641 1211	.831 9406 6 0281 2577	.360 7609 2 6148 1118
Dec. 1	-0.371 7680 +16 2798 +1157	-0.837 9687 - 5 7681 +2600	-0.363 3757 -2 5019 +1129
2	.355 4882 16 3901 1103	.843 7368 5 5061 2620	.365 8776 2 3882 1137
3	.339 0981 16 4949 1048	.849 2429 5 2421 2640	.368 2658 2 2735 1147
4	.322 6032 16 5942 993	.854 4850 4 9765 2656	.370 5393 2 1583 1152
5	.306 0090 16 6881 939	.859 4615 4 7095 2670	.372 6976 2 0422 1161
6	-0.289 3209 +16 7764 + 883	-0.864 1710 - 4 4409 +2686	-0.374 7398 -1 9257 +1165
7	.272 5445 16 8594 830	.868 6119 4 1715 2694	.376 6655 1 8087 1170
8	.255 6851 16 9372 778	.872 7834 3 9007 2708	.378 4742 1 6911 1176
9	.238 7479 17 0095 723	.876 6841 3 6290 2717	.380 1653 1 5732 1179
10	.221 7384 17 0769 674	.880 3131 3 3563 2727	.381 7385 1 4549 1183
11	-0.204 6615 +17 1387 + 618	-0.883 6694 - 3 0828 +2735	-0.383 1934 -1 3363 +1186
12	.187 5228 17 1955 568	.886 7522 2 8083 2745	.384 5297 1 2172 1191
13	.170 3273 17 2473 518	.889 5605 2 5333 2750	.385 7469 1 0980 1192
14	.153 0800 17 2938 465	.892 0938 2 2575 2758	.386 8449 9785 1195
15	.135 7862 17 3351 413	.894 3513 1 9810 2765	.387 8234 8587 1198
16	-0.118 4511 +17 3715 + 364	-0.896 3323 - 1 7040 +2770	-0.388 6821 - 7386 +1201
17	.101 0796 17 4027 312	.898 0363 1 4265 2775	.389 4207 6185 1201
18	.083 6769 17 4289 262	.899 4628 1 1486 2779	.390 0392 4980 1205
19	.066 2480 17 4500 211	.900 6114 8699 2787	.390 5372 3774 1206
20	.048 7980 17 4660 160	.901 4813 5911 2788	.390 9146 2565 1209
21	-0.031 3320 +17 4769 + 109	-0.902 0724 - 3116 +2795	-0.391 1711 - 1356 +1209
22	.013 8551 17 4827 58	.902 3840 - 319 2797	.391 3067 - 144 1212
23	+ .003 6276 17 4831 + 4	.902 4159 + 2483 2802	.391 3211 + 1070 1214
24	.021 1107 17 4783 - 48	.902 1676 + 5288 2805	.391 2141 + 2286 1216
25	.038 5890 17 4680 103	.901 6388 8095 2807	.390 9855 3502 1216
26	+0.056 0570 +17 4522 - 158	-0.900 8293 + 1 0905 +2810	-0.390 6353 + 4720 +1218
27	.073 5092 17 4308 214	.899 7388 1 3712 2807	.390 1633 5940 1220
28	.090 9400 17 4035 273	.898 3676 1 6521 2809	.389 5693 7157 1217
29	.108 3435 17 3705 330	.896 7155 1 9326 2805	.388 8536 8375 1218
30	.125 7140 17 3317 388	.894 7829 2 2126 2800	.388 0161 9591 1216
31	+0.143 0457 +17 2869 - 448	-0.892 5703 + 2 4921 +2795	-0.387 0570 +1 0803 +1212
32	+0.160 3326 - 504	-0.890 0782 +2783	-0.385 9767 +1210

MEAN LONGITUDE AND ANOMALY ; PRECESSIONAL CONSTANTS

Date			Epoch 1967.0	
Mean Longitude			Mean obliquity	
Mean Anomaly			ϵ 23° 26' 36".87 = 23° 44358	
Jan.	0	278.°9799	sin ϵ 0.397 84576	
	10	288.8364	cos ϵ 0.917 45231	
	20	298.6929	tan ϵ 0.433 64190	
	30	308.5494	cosec ϵ 2.513 5369	
Feb.	9	318.4058	sec ϵ 1.089 9749	
	19	328.2623	cot ϵ 2.306 0503	
Mar.	1	338.1188	Annual general precession p 50".2713	
	11	347.9753	= 0°.013 9643	
	21	357.8317	Annual precession in R.A. m 38.07359	
	31	7.6882	Annual precession in Dec. n 18.33608	
Apr.	10	17.5447	= 20".0411	
	20	27.4012	Longitude of axis of rotation Π 174° 33'.8	
	30	37.2576	= 174°.563	
May	10	47.1141	Annual rate of rotation of ecliptic π 0".4706	
	20	56.9706	= 0°.000 1307	
June	30	66.8270	For reduction from	
	9	76.6835	1967.0 to 1950.0	
	19	86.5400	1950.0 to 1967.0	
July	29	96.3965	ζ_0 -6' 31".87	
	9	106.2529	= -268.125	
	19	116.1094	z -6' 31".85	
Aug.	29	125.9659	= -268.123	
	8	135.8224	sin θ -0.001 65181	
	18	145.6788	tan $\frac{1}{2} \theta$ -0.000 82591	
Sept.	28	155.5353	M^s -528.248	
	7	165.3918	N^s -228.714	
	17	175.2483	N'' -340".71	
Oct.	27	185.1047	a -14' 14".58	
	7	194.9612	= -0°.23738	
	17	204.8177	b -8".00	
Nov.	27	214.6741	= -0°.002 223	
	6	224.5306	c +5° 23'.8	
	16	234.3871	= +5°.396	
Dec.	26	244.2436	Formulæ :	
	6	254.1000	$a = a_0 + M + N \sin \alpha_m \tan \delta_m$	
	16	263.9565	$\delta = \delta_0 + N \cos \alpha_m$	
Daily motion	26	273.8130	$\lambda = \lambda_0 + a - b \cos(\lambda_0 + c) \tan \beta_0$	
	36	283.6695	$\beta = \beta_0 + b \sin(\lambda_0 + c)$	
			$\Omega = \Omega_0 + a - b \sin(\Omega_0 + c) \cot i_0$	
Epoch 1967 January 1.0			$i = i_0 + b \cos(\Omega_0 + c)$	
Mean longitude of perigee Γ 282.37287			$\omega = \omega_0 + b \sin(\Omega_0 + c) \operatorname{cosec} i_0$	
Eccentricity e 0.0167230			where α_m, δ_m are for the mean epoch.	

MEAN EQUATOR, ORBIT, LONGITUDE AND ELONGATION

Date	Mean Equator			Orbit		Mean Longitude	Mean Elongation
	i	Δ	Ω'	Γ'	Ω	ζ	D
Jan. 0	22°353	225°926	-2°773	180°4385	43°3753	143°4449	224°4649
10	22°343	225°373	2°746	181°5525	42°8457	275°2088	346°3724
20	22°333	224°819	2°720	182°6665	42°3162	46°9728	108°2799
30	22°323	224°266	2°693	183°7806	41°7866	178°7368	230°1874
Feb. 9	22°313	223°711	2°667	184°8946	41°2571	310°5007	352°0949
19	22°304	223°157	-2°639	186°0086	40°7276	82°2647	114°0024
Mar. 1	22°294	222°602	2°612	187°1227	40°1980	214°0286	235°9099
11	22°284	222°047	2°584	188°2367	39°6685	345°7926	357°8174
21	22°275	221°492	2°556	189°3508	39°1389	117°5566	119°7248
31	22°266	220°936	2°528	190°4648	38°6094	249°3205	241°6323
Apr. 10	22°256	220°381	-2°500	191°5788	38°0799	21°0845	3°5398
20	22°247	219°825	2°471	192°6929	37°5503	152°8485	125°4473
30	22°238	219°269	2°442	193°8069	37°0208	284°6124	247°3548
May 10	22°229	218°712	2°413	194°9209	36°4913	56°3764	9°2623
20	22°220	218°156	2°384	196°0350	35°9617	188°1404	131°1698
30	22°212	217°599	-2°354	197°1490	35°4322	319°9043	253°0773
June 9	22°203	217°042	2°324	198°2631	34°9026	91°6683	14°9848
19	22°194	216°485	2°294	199°3771	34°3731	223°4323	136°8923
29	22°186	215°928	2°264	200°4911	33°8436	355°1962	258°7998
July 9	22°178	215°371	2°234	201°6052	33°3140	126°9602	20°7073
19	22°170	214°813	-2°203	202°7192	32°7845	258°7242	142°6147
29	22°162	214°255	2°172	203°8332	32°2549	30°4881	264°5222
Aug. 8	22°154	213°697	2°141	204°9473	31°7254	162°2521	26°4297
18	22°146	213°138	2°109	206°0613	31°1959	294°0161	148°3372
28	22°138	212°580	2°078	207°1754	30°6663	65°7800	270°2447
Sept. 7	22°131	212°021	-2°046	208°2894	30°1368	197°5440	32°1522
17	22°123	211°462	2°014	209°4034	29°6073	329°3079	154°0597
27	22°116	210°902	1°982	210°5175	29°0777	101°0719	275°9672
Oct. 7	22°109	210°343	1°949	211°6315	28°5482	232°8359	37°8747
17	22°102	209°783	1°916	212°7455	28°0186	4°5998	159°7822
27	22°095	209°224	-1°884	213°8596	27°4891	136°3638	281°6897
Nov. 6	22°088	208°664	1°851	214°9736	26°9596	268°1278	43°5972
16	22°081	208°104	1°817	216°0876	26°4300	39°8917	165°5046
26	22°074	207°543	1°784	217°2017	25°9005	171°6557	287°4121
Dec. 6	22°068	206°983	1°751	218°3157	25°3709	303°4197	49°3196
16	22°062	206°423	-1°717	219°4298	24°8414	75°1836	171°2271
26	22°055	205°862	1°683	220°5438	24°3119	206°9476	293°1346
36	22°049	205°301	-1°649	221°6578	23°7823	338°7116	55°0421
Daily motion				+0°·111404	-0°·052954	13°·176396	12°·190749

Epoch 1900 January 0.5 E.T.

Eccentricity = 0.05490 0489

Inclination = 5°·145 3964

MOON, 1967
FOR 0^h AND 12^h EPHEMERIS TIME

Date		Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Jan.	0·0	141° 19' 55·61	+5° 03' 31·10	16' 09·02	59' 16·455	U 0 03·2145 ^d 12·4454 ^h
	0·5	148 28 31·44	4 56 44·89	16 10·18	59 20·694 + 4·239	L 0 15·6599
	1·0	155 37 19·03	4 45 20·74	16 10·81	59 23·006 + 2·312	U 1 04·0919
	1·5	162 45 47·75	4 29 30·06	16 10·95	59 23·534 + 0·528	L 1 16·5122
	2·0	169 53 31·54	4 09 29·32	16 10·65	59 22·442 - 1·092	U 2 04·9231
					2·545	4039
	2·5	177 00 09·23	+3 45 39·42	16 09·96	59 19·897	L 2 17·3270
	3·0	184 05 24·46	3 18 25·07	16 08·91	59 16·062 - 3·835	U 3 05·7269
	3·5	191 09 05·36	2 48 14·05	16 07·56	59 11·079 4·983	L 3 18·1255
	4·0	198 11 03·85	2 15 36·58	16 05·92	59 05·070 6·009	U 4 06·5257
	4·5	205 11 14·84	1 41 04·63	16 04·03	58 58·127 6·943	L 4 18·9302
					7·812	4114
	5·0	212 09 35·29	+1 05 11·36	16 01·90	58 50·315	U 5 07·3416
	5·5	219 06 03·20	+0 28 30·54	15 59·54	58 41·671 - 8·644	L 5 19·7620
	6·0	226 00 36·72	-0 08 23·99	15 56·97	58 32·212 9·459	U 6 08·1929
	6·5	232 53 13·33	0 44 58·86	15 54·17	58 21·937 10·275	L 6 20·6355
	7·0	239 43 49·22	1 20 41·66	15 51·15	58 10·842 11·095	U 7 09·0899
					11·919	4652
	7·5	246 32 18·85	-1 55 01·51	15 47·90	57 58·923	L 7 21·5551
	8·0	253 18 34·79	2 27 29·53	15 44·43	57 46·185 - 12·738	U 8 10·0291
	8·5	260 02 27·70	2 57 39·36	15 40·74	57 32·656 13·529	L 8 22·5091
	9·0	266 43 46·66	3 25 07·58	15 36·85	57 18·386 14·270	U 9 10·9910
	9·5	273 22 19·64	3 49 34·15	15 32·79	57 03·456 14·930	L 9 23·4707
					15·475	4732
	10·0	279 57 54·12	-4 10 42·61	15 28·57	56 47·981	U 10 11·9439
	10·5	286 30 17·92	4 28 20·33	15 24·24	56 32·106 - 15·875	12·4628
	11·0	292 59 19·94	4 42 18·50	15 19·86	56 16·011 16·095	...
	11·5	299 24 51·03	4 52 32·05	15 15·47	55 59·902 16·109	L 11 00·4067
	12·0	305 46 44·75	4 58 59·46	15 11·14	55 44·007 15·895	U 11 12·8561
					15·436	L 12 01·2900
						4175
	12·5	312 04 58·02	-5 01 42·46	15 06·93	55 28·571	U 12 13·7075
	13·0	318 19 31·60	5 00 45·60	15 02·92	55 13·850 - 14·721	L 13 02·1084
	13·5	324 30 30·56	4 56 15·86	14 59·18	55 00·100 13·750	U 13 14·4934
	14·0	330 38 04·37	4 48 22·19	14 55·77	54 47·579 12·521	L 14 02·8639
	14·5	336 42 27·05	4 37 15·07	14 52·76	54 36·530 11·049	U 14 15·2214
					9·343	3467
	15·0	342 43 57·06	-4 23 06·16	14 50·21	54 27·187	L 15 03·5681
	15·5	348 42 57·09	4 06 07·88	14 48·19	54 19·763 - 7·424	U 15 15·9061
	16·0	354 39 53·81	3 46 33·26	14 46·74	54 14·449 5·314	L 16 04·2377
	16·5	0 35 17·51	3 24 35·65	14 45·91	54 11·411 3·038	U 16 16·5651
	17·0	6 29 41·69	3 00 28·67	14 45·74	54 10·788 - 0·623	L 17 04·8909
					+ 1·897	3264
	17·5	12 23 42·64	-2 34 26·16	14 46·26	54 12·685	U 17 17·2173
	18·0	18 17 58·91	2 06 42·26	14 47·48	54 17·178 + 4·493	L 18 05·5470
	18·5	24 13 10·82	1 37 31·44	14 49·43	54 24·303 7·125	U 18 17·8822
	19·0	30 09 59·88	1 07 08·74	14 52·08	54 34·062 9·759	L 19 06·2256
	19·5	36 09 08·19	0 35 49·96	14 55·45	54 46·409 12·347	U 19 18·5796
					14·847	3540
	20·0	42 11 17·71	-0 03 51·88	14 59·49	55 01·256	L 20 06·9465
	20·5	48 17 09·51	+0 28 27·46	15 04·18	55 18·464 + 17·208	U 20 19·3287
	21·0	54 27 22·89	1 00 48·53	15 09·46	55 37·840 19·376	L 21 07·7281
	21·5	60 42 34·35	1 32 50·08	15 15·26	55 59·136 21·296	U 21 20·1463
	22·0	67 03 16·52	2 04 09·01	15 21·50	56 22·043 22·907	L 22 08·5839
					24·151	4376
	22·5	73 29 56·97	+2 34 20·33	15 28·08	56 46·194	U 22 21·0408
	23·0	80 02 56·90	+3 02 57·26	15 34·89	57 11·168 + 24·974	L 23 09·5157
						12·4749

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Jan. 23.0	80° 02' 56".90	+3° 02' 57".26	15' 34".89	57' 11".168	L 23 09.5157 ^{d h} 12.4901 ^h
23.5	86 42 29.91	3 29 31.57	15 41.78	57 36.486 +25.318	U 23 22.0058 5016
24.0	93 28 40.79	3 53 34.05	15 48.64	58 01.634 25.148	L 24 10.5074 5080
24.5	100 21 24.55	4 14 35.34	15 55.29	58 26.062 24.428	U 24 23.0154 5093
25.0	107 20 25.66	4 32 06.84	16 01.60	58 49.216 23.154	L 25 11.5247 5053
25.5	114 25 17.94	+4 45 42.01	16 07.41	59 10.549 +19.004	...
26.0	121 35 24.81	4 54 57.61	16 12.59	59 29.553 16.229	U 26 00.0300 ...
26.5	128 50 00.29	4 59 35.06	16 17.01	59 45.782 13.090	L 26 12.5270 12.4970
27.0	136 08 10.69	4 59 21.68	16 20.58	59 58.872 9.697	U 27 01.0124 4854
27.5	143 28 56.73	4 54 11.60	16 23.22	60 08.569 6.163	L 27 13.4843 4719
28.0	150 51 16.22	+4 44 06.39	16 24.90	60 14.732 +2.615	U 28 01.9422 12.4445
28.5	158 14 06.86	4 29 15.21	16 25.61	60 17.347 -0.833	L 28 14.3867 4326
29.0	165 36 28.99	4 09 54.40	16 25.38	60 16.514 4.073	U 29 02.8193 4226
29.5	172 57 28.01	3 46 26.84	16 24.27	60 12.441 7.017	L 29 15.2419 4152
30.0	180 16 16.30	3 19 20.77	16 22.36	60 05.424 9.605	U 30 03.6571 4105
30.5	187 32 14.52	+2 49 08.57	16 19.75	59 55.819 -11.796	L 30 16.0676 12.4085
31.0	194 44 52.20	2 16 25.39	16 16.53	59 44.023 13.577	U 31 04.4761 4092
31.5	201 53 47.76	1 41 47.87	16 12.83	59 30.446 14.955	L 31 16.8853 4126
Feb. 1.0	208 58 47.89	1 05 53.02	16 08.76	59 15.491 15.957	U 1 05.2979 4183
1.5	215 59 46.64	+0 29 17.21	16 04.41	58 59.534 16.620	L 1 17.7162 4257
2.0	222 56 44.17	-0 07 24.51	15 59.88	58 42.914 -16.991	U 2 06.1419 12.4347
2.5	229 49 45.37	0 43 38.95	15 55.25	58 25.923 17.122	L 2 18.5766 4443
3.0	236 38 58.44	1 18 55.18	15 50.59	58 08.801 17.063	U 3 07.0209 4537
3.5	243 24 33.66	1 52 44.71	15 45.94	57 51.738 16.859	L 3 19.4746 4622
4.0	250 06 42.10	2 24 41.67	15 41.35	57 34.879 16.556	U 4 07.9368 4687
4.5	256 45 34.72	-2 54 22.87	15 36.84	57 18.323 -16.185	L 4 20.4055 12.4723
5.0	263 21 21.56	3 21 27.85	15 32.43	57 02.138 15.774	U 5 08.8778 4726
5.5	269 54 11.20	3 45 38.98	15 28.13	56 46.364 15.341	L 5 21.3504 4690
6.0	276 24 10.42	4 06 41.44	15 23.95	56 31.023 14.894	U 6 09.8194 4619
6.5	282 51 24.11	4 24 23.28	15 19.89	56 16.129 14.437	L 6 22.2813 4516
7.0	289 15 55.35	-4 38 35.46	15 15.96	56 01.692 -13.963	U 7 10.7329 12.4388
7.5	295 37 45.71	4 49 11.83	15 12.15	55 47.729 13.463	L 7 23.1717 4243
8.0	301 56 55.63	4 56 09.13	15 08.49	55 34.266 12.922	U 8 11.5960 4092
8.5	308 13 24.99	4 59 26.86	15 04.97	55 21.344 12.322	...
9.0	314 27 13.68	4 59 07.25	15 01.61	55 09.022 11.645	L 9 00.0052 3941
9.5	320 38 22.24	-4 55 15.01	14 58.44	54 57.377 -10.868	U 9 12.3993 12.3795
10.0	326 46 52.49	4 47 57.13	14 55.48	54 46.509 9.977	L 10 00.7788 3663
10.5	332 52 48.11	4 37 22.68	14 52.76	54 36.532 8.952	U 10 13.1451 3546
11.0	338 56 15.14	4 23 42.42	14 50.32	54 27.580 7.782	L 11 01.4997 3446
11.5	344 57 22.44	4 07 08.59	14 48.20	54 19.798 6.454	U 11 13.8443 3366
12.0	350 56 21.98	-3 47 54.57	14 46.44	54 13.344 -4.965	L 12 02.1809 12.3307
12.5	356 53 29.07	3 26 14.62	14 45.09	54 08.379 3.311	U 12 14.5116 3270
13.0	2 49 02.53	3 02 23.65	14 44.18	54 05.068 -1.497	L 13 02.8386 3255
13.5	8 43 24.64	2 36 37.00	14 43.78	54 03.571 +0.473	U 13 15.1641 3261
14.0	14 37 01.12	2 09 10.35	14 43.91	54 04.044 2.585	L 14 03.4902 3290
14.5	20 30 21.00	-1 40 19.59	14 44.61	54 06.629 +4.824	U 14 15.8192 12.3343
15.0	26 23 56.37	-1 10 20.83	14 45.92	54 11.453	L 15 04.1535

MOON, 1967

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Feb. 15.0	26 23 56.37	-1 10 20.83	14 45.92	54 11.453	L 15 04.1535 ^{d h} U 15 16.4952 ^h
15.5	32 18 22.13	0 39 30.42	14 47.88	54 18.625 + 7.172	L 16 04.8467 ^{12.3417} U 16 17.2101 ^{.3515}
16.0	38 14 15.57	-0 08 05.07	14 50.49	54 28.226 9.601	L 17 05.5876 ^{.3634} U 17 07.2675 ^{.3775}
16.5	44 12 15.98	+0 23 38.04	14 53.79	54 40.307 12.081	L 18 06.3917 ^{.3934} U 18 18.8205 ^{.4107}
17.0	50 13 04.07	0 55 21.07	14 57.76	54 54.882 14.575	L 19 07.2675 ^{.4288} U 19 09.7317 ^{.4470}
17.5	56 17 21.38	+1 26 45.30	15 02.40	55 11.926 17.044	L 20 08.2110 ^{.4642} U 20 10.7040 ^{.4793}
18.0	62 25 49.46	1 57 30.96	15 07.69	55 31.359 +19.433	L 21 09.2015 ^{.4992} U 21 21.7040 ^{.5025}
18.5	68 39 08.97	2 27 17.02	15 13.60	55 53.051 21.692	L 22 10.2052 ^{.4958} U 22 22.7010 ^{.4873}
19.0	74 57 58.62	2 55 41.08	15 20.08	56 16.803 23.752	L 23 11.1883 ^{.4768} U 23 23.6651 ^{.4653}
19.5	81 22 53.87	3 22 19.28	15 27.04	56 42.350 25.547	L 24 12.1304 ^{.4542} U 24 00.5846 ^{.4359}
20.0	87 54 25.59	+3 46 46.43	15 34.39	57 09.352 27.002	L 25 13.0287 ^{.4297} U 25 16.4810 ^{.4509}
20.5	94 32 58.44	4 08 36.18	15 42.03	57 37.389 +28.037	L 26 13.8943 ^{.4262} U 26 02.3205 ^{.4251}
21.0	101 18 49.29	4 27 21.56	15 49.82	58 05.967 28.578	L 27 14.7456 ^{.4265} U 27 03.1721 ^{.4302}
21.5	108 12 05.52	4 42 35.61	15 57.60	58 34.517 28.550	L 28 15.6023 ^{.4358} U 28 04.0381 ^{.4429}
22.0	115 12 43.60	4 53 52.39	16 05.19	59 02.409 27.892	L 29 16.4810 ^{.4509} U 29 06.8033 ^{.4747}
22.5	122 20 27.87	+5 00 48.22	16 12.43	59 28.969 26.560	L 30 19.2780 ^{.4713} U 30 07.7493 ^{.4645}
23.0	129 34 49.89	5 03 03.02	16 19.11	59 53.504 +24.535	L 31 20.2138 ^{.4547} U 31 08.6685 ^{.4424}
23.5	136 55 08.41	5 00 21.85	16 25.06	60 15.333 21.829	L 32 21.1109 ^{.4285} U 32 09.5394 ^{.42136}
24.0	144 20 30.17	4 52 36.37	16 30.10	60 33.823 18.490	L 33 22.0008 ^{.4645} U 33 10.3517 ^{.3987}
24.5	151 49 51.58	4 39 45.96	16 34.08	60 48.431 14.608	L 34 22.7360 ^{.3708} U 34 11.1068 ^{.3588}
25.0	159 22 01.21	+4 21 58.59	16 36.89	60 58.731 10.300	L 35 23.4656 ^{.3485} U 35 11.8141 ^{.3485}
25.5	166 55 42.89	3 59 30.99	16 38.44	61 04.453 + 5.722	L 36 24.1530 ^{.3485} U 36 12.5117 ^{.3485}
26.0	174 29 39.20	3 32 48.26	16 38.73	61 05.493 + 1.040	L 37 24.8446 ^{.3485} U 37 13.249 ^{.3485}
26.5	182 02 35.01	3 02 22.84	16 37.76	61 01.922 - 3.571	L 38 25.5876 ^{.3485} U 38 14.0381 ^{.3485}
27.0	189 33 20.68	2 28 52.97	16 35.59	60 53.976 7.946	L 39 26.3205 ^{.3485} U 39 14.810 ^{.3485}
27.5	197 00 54.68	+1 53 00.84	16 32.34	60 42.033 11.943	L 40 27.0517 ^{.3485} U 40 15.6023 ^{.3485}
28.0	204 24 25.46	1 15 30.61	16 28.13	60 26.587 -15.446	L 41 27.780 ^{.3485} U 41 13.4136 ^{.3485}
28.5	211 43 12.45	+0 37 06.57	16 23.12	60 08.208 18.379	L 42 28.5117 ^{.3485} U 42 11.1068 ^{.3485}
Mar. 1.0	218 56 46.30	-0 01 28.54	16 17.48	59 47.503 20.705	L 43 29.2446 ^{.3485} U 43 08.6685 ^{.3485}
1.5	226 04 48.40	0 39 34.70	16 11.37	59 25.087 22.416	L 44 30.0008 ^{.3485} U 44 07.7493 ^{.3485}
2.0	233 07 09.90	-1 16 35.55	16 04.96	59 01.549 23.538	L 45 30.7360 ^{.3485} U 45 06.8033 ^{.3485}
2.5	240 03 50.39	1 51 58.87	15 58.39	58 37.432 -24.117	L 46 31.4656 ^{.3485} U 46 05.9394 ^{.3485}
3.0	246 54 56.36	2 25 16.71	15 51.79	58 13.216 24.216	L 47 32.2008 ^{.3485} U 47 05.0267 ^{.3485}
3.5	253 40 39.71	2 56 05.41	15 45.28	57 49.311 23.905	L 48 32.9446 ^{.3485} U 48 04.1109 ^{.3485}
4.0	260 21 16.19	3 24 05.31	15 38.94	57 26.050 23.261	L 49 33.6876 ^{.3485} U 49 03.2052 ^{.3485}
4.5	266 57 04.13	-3 49 00.50	15 32.85	57 03.698 22.352	L 50 34.4305 ^{.3485} U 50 02.2923 ^{.3485}
5.0	273 28 23.25	4 10 38.43	15 27.06	56 42.450 -21.248	L 51 35.1738 ^{.3485} U 51 01.3817 ^{.3485}
5.5	279 55 33.66	4 28 49.63	15 21.61	56 22.442 20.008	L 52 35.9167 ^{.3485} U 52 00.4705 ^{.3485}
6.0	286 18 55.12	4 43 27.37	15 16.52	56 03.758 18.684	L 53 36.6596 ^{.3485} U 53 00.5594 ^{.3485}
6.5	292 38 46.47	4 54 27.45	15 11.80	55 46.440 17.318	L 54 37.4025 ^{.3485} U 54 00.6482 ^{.3485}
7.0	298 55 25.25	-5 01 47.98	15 07.46	55 30.499 15.941	L 55 38.1454 ^{.3485} U 55 00.7370 ^{.3485}
7.5	305 09 07.47	5 05 29.23	15 03.49	55 15.919 -14.580	L 56 38.8883 ^{.3485} U 56 00.8258 ^{.3485}
8.0	311 20 07.59	5 05 33.49	14 59.88	55 02.670 13.249	L 57 39.6312 ^{.3485} U 57 00.9146 ^{.3485}
8.5	317 28 38.55	5 02 04.99	14 56.62	54 50.711 11.959	L 58 40.3741 ^{.3485} U 58 01.0034 ^{.3485}
9.0	323 34 52.03	4 55 09.81	14 53.70	54 40.003 10.708	L 59 41.1170 ^{.3485} U 59 01.0922 ^{.3485}
9.5	329 38 58.66	-4 44 55.78	14 51.12	54 30.509 9.494	L 60 41.8599 ^{.3485} U 60 01.1810 ^{.3485}
10.0	335 41 08.41	-4 31 32.39	14 48.85	54 22.200 - 8.309	L 61 42.6028 ^{.3485} U 61 01.2698 ^{.3485}

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Mar. 10-0	335 41 08.41	-4 31 32.39	14 48.85	54 22.200 - 7.136	U 10 11.8141 ^{d h} 12.3398 ^h
10-5	341 41 31.02	4 15 10.70	14 46.91	54 15.064 5.961	... ...
11-0	347 40 16.37	3 56 03.12	14 45.28	54 09.103 4.768	L 11 00.1539 ...
11-5	353 37 34.93	3 34 23.37	14 43.99	54 04.335 3.535	U 11 12.4870 ...
12-0	359 33 38.23	3 10 26.21	14 43.02	54 00.800 2.247	L 12 00.8155 ...
12-5	5 28 39.16	-2 44 27.34	14 42.41	53 58.553 - 0.888	U 12 13.1413 12.3252
13-0	11 22 52.38	2 16 43.17	14 42.17	53 57.665 + 0.559	L 13 01.4665 ...
13-5	17 16 34.57	1 47 30.72	14 42.32	53 58.224 2.102	U 13 13.7932 ...
14-0	23 10 04.69	1 17 07.47	14 42.89	54 00.326 3.751	L 14 02.1233 ...
14-5	29 03 44.09	0 45 51.21	14 43.91	54 04.077 5.506	U 14 14.4590 ...
15-0	34 57 56.63	-0 14 00.03	14 45.41	54 09.583 + 7.371	L 15 02.8023 12.3529
15-5	40 53 08.67	+0 18 07.78	14 47.42	54 16.954 9.335	U 15 15.1552 ...
16-0	46 49 49.01	0 50 13.68	14 49.97	54 26.289 11.389	L 16 03.5195 ...
16-5	52 48 28.68	1 21 58.85	14 53.07	54 37.678 13.512	U 16 15.8969 ...
17-0	58 49 40.73	1 53 04.12	14 56.75	54 51.190 15.680	L 17 04.2890 ...
17-5	64 53 59.84	+2 23 09.89	15 01.02	55 06.870 +17.860	U 17 16.6966 12.4237
18-0	71 02 01.78	2 51 56.01	15 05.89	55 24.730 20.013	L 18 05.1203 ...
18-5	77 14 22.84	3 19 01.66	15 11.34	55 44.743 22.086	U 18 17.5598 ...
19-0	83 31 38.97	3 44 05.37	15 17.36	56 06.829 24.022	L 19 06.0139 ...
19-5	89 54 24.86	4 06 44.93	15 23.90	56 30.851 25.755	U 19 18.4808 ...
20-0	96 23 12.78	+4 26 37.56	15 30.92	56 56.606 +27.207	L 20 06.9575 12.4833
20-5	102 58 31.27	4 43 20.08	15 38.33	57 23.813 28.298	U 20 19.4408 ...
21-0	109 40 43.67	4 56 29.35	15 46.04	57 52.111 28.940	L 21 07.9269 ...
21-5	116 30 06.49	5 05 42.85	15 53.93	58 21.051 29.050	U 21 20.4121 ...
22-0	123 26 47.83	5 10 39.50	16 01.84	58 50.101 28.547	L 22 08.8933 ...
22-5	130 30 45.85	+5 11 00.73	16 09.62	59 18.648 +27.365	U 22 21.3681 12.4667
23-0	137 41 47.42	5 06 31.73	16 17.07	59 46.013 25.462	L 23 09.8348 ...
23-5	144 59 27.23	4 57 02.81	16 24.01	60 11.475 22.818	U 23 22.2931 ...
24-0	152 23 07.47	4 42 30.76	16 30.23	60 34.293 19.461	L 24 10.7433 ...
24-5	159 51 58.19	4 23 00.11	16 35.53	60 53.754 15.456	U 24 23.1864 ...
25-0	167 24 58.48	+3 58 43.94	16 39.74	61 09.210 +10.911	L 25 11.6242 12.4346
25-5	175 00 58.48	3 30 04.25	16 42.71	61 20.121 5.977	... ...
26-0	182 38 42.08	2 57 31.73	16 44.34	61 26.098 + 0.834	U 26 00.0588 ...
26-5	190 16 50.10	2 21 44.69	16 44.57	61 26.932 - 4.321	L 26 12.4926 ...
27-0	197 54 03.68	1 43 27.53	16 43.39	61 22.611 9.294	U 27 00.9279 ...
27-5	205 29 07.60	+1 03 28.65	16 40.86	61 13.317 -13.901	L 27 13.3672 12.4454
28-0	213 00 53.17	+0 22 38.13	16 37.07	60 59.416 17.994	U 28 01.8126 ...
28-5	220 28 20.52	-0 18 14.54	16 32.17	60 41.422 21.459	L 28 14.2657 ...
29-0	227 50 40.21	0 58 22.51	16 26.32	60 19.963 24.226	U 29 02.7276 ...
29-5	235 07 13.98	1 37 03.16	16 19.72	59 55.737 26.270	L 29 15.1986 ...
30-0	242 17 34.88	-2 13 39.22	16 12.57	59 29.467 -27.604	U 30 03.6781 12.4863
30-5	249 21 26.78	2 47 39.31	16 05.05	59 01.863 28.265	L 30 16.1644 ...
31-0	256 18 43.41	3 18 38.09	15 57.34	58 33.598 28.323	U 31 04.6549 ...
31-5	263 09 27.15	3 46 15.99	15 49.63	58 05.275 27.852	L 31 17.1460 ...
Apr. 1-0	269 53 47.64	4 10 18.72	15 42.04	57 37.423 26.937	U 1 05.6341 ...
1-5	276 32 00.41	-4 30 36.65	15 34.70	57 10.486 -25.664	L 1 18.1152 12.4704
2-0	283 04 25.47	-4 47 04.12	15 27.71	56 44.822	U 2 06.5856

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Apr. 1-0	269 53 47.64	-4 10 18.72	15 42.04	57 37.423	U 1 05.6341 ^b
1-5	276 32 00.41	4 30 36.65	15 34.70	57 10.486	L 1 18.1152 ^{12.4811}
2-0	283 04 25.47	4 47 04.12	15 27.71	56 44.822	U 2 06.5856 ^{.4704}
2-5	289 31 26.10	4 59 38.81	15 21.14	56 20.708	L 2 19.0427 ^{.4571}
3-0	295 53 27.71	5 08 21.12	15 15.05	55 58.348	U 3 07.4843 ^{.4416}
3-5	302 10 56.94	-5 13 13.71	15 09.47	55 37.877	L 3 19.9095 ^{.4252}
4-0	308 24 20.80	5 14 21.07	15 04.43	55 19.375	U 4 08.3180 ^{12.4085}
4-5	314 34 06.13	5 11 49.24	14 59.93	55 02.873	L 4 20.7105 ^{.3925}
5-0	320 40 39.04	5 05 45.57	14 55.98	54 48.363	U 5 09.0881 ^{.3776}
5-5	326 44 24.62	4 56 18.61	14 52.56	54 35.807	L 5 21.4521 ^{.3640}
6-0	332 45 46.66	-4 43 38.01	14 49.65	54 25.144	U 6 09.8046 ^{.3525}
6-5	338 45 07.59	4 27 54.46	14 47.24	54 16.296	L 6 22.1473 ^{12.3427}
7-0	344 42 48.41	4 09 19.73	14 45.30	54 09.178	U 7 10.4823 ^{.3350}
7-5	350 39 08.74	3 48 06.58	14 43.81	54 03.701	L 7 22.8117 ^{.3294}
8-0	356 34 26.97	3 24 28.81	14 42.74	53 59.779	U 8 11.1376 ^{.3259}
8-5	2 29 00.47	-2 58 41.22	14 42.08	53 57.333	L 8 23.4620 ^{.3244}
9-0	8 23 05.76	2 30 59.56	14 41.80	53 56.296	U 9 11.7871 ^{12.3251}
9-5	14 16 58.81	2 01 40.50	14 41.88	53 56.612	L ^{.3276}
10-0	20 10 55.33	1 31 01.51	14 42.33	53 58.245	U 10 00.1147 ^{...}
10-5	26 05 11.03	0 59 20.82	14 43.12	54 01.172	L 10 12.4470 ^{.3323}
11-0	32 00 01.93	-0 26 57.29	14 44.27	54 05.390	U 11 00.7859 ^{.3389}
11-5	37 55 44.65	+0 05 49.70	14 45.78	54 10.912	L 11 00.7859 ^{12.3474}
12-0	43 52 36.64	0 38 40.33	14 47.64	54 17.766	U 11 13.1333 ^{.3577}
12-5	49 50 56.38	1 11 14.51	14 49.89	54 25.993	L 12 01.4910 ^{.3696}
13-0	55 51 03.56	1 43 11.90	14 52.52	54 35.646	U 12 13.8606 ^{.3827}
13-5	61 53 19.15	+2 14 12.05	14 55.55	54 46.781	L 13 02.2433 ^{.3969}
14-0	67 58 05.44	2 43 54.43	14 59.00	54 59.455	U 13 14.6402 ^{12.4115}
14-5	74 05 45.95	3 11 58.48	15 02.89	55 13.719	L 14 03.0517 ^{.4260}
15-0	80 16 45.28	3 38 03.68	15 07.22	55 29.612	U 14 15.4777 ^{.4395}
15-5	86 31 28.79	4 01 49.60	15 12.00	55 47.152	L 15 03.9172 ^{.4515}
16-0	92 50 22.23	+4 22 55.94	15 17.22	56 06.329	U 15 16.3687 ^{.4609}
16-5	99 13 51.17	4 41 02.66	15 22.88	56 27.097	L 16 04.8296 ^{12.4676}
17-0	105 42 20.32	4 55 50.17	15 28.95	56 49.364	U 16 17.2972 ^{.4709}
17-5	112 16 12.69	5 06 59.53	15 35.38	57 12.980	L 17 05.7681 ^{.4709}
18-0	118 55 48.61	5 14 12.86	15 42.12	57 37.734	U 17 18.2390 ^{.4679}
18-5	125 41 24.64	+5 17 13.82	15 49.10	58 03.339	L 18 06.7069 ^{.4627}
19-0	132 33 12.32	5 15 48.23	15 56.21	58 29.435	U 18 19.1696 ^{12.4559}
19-5	139 31 16.97	5 09 44.92	16 03.33	58 55.580	L 19 07.6255 ^{.4483}
20-0	146 35 36.44	4 58 56.58	16 10.33	59 21.259	U 19 20.0738 ^{.4408}
20-5	153 46 00.05	4 43 20.84	16 17.04	59 45.887	L 20 08.5146 ^{.4343}
21-0	161 02 07.72	+4 23 01.22	16 23.29	60 08.830	U 20 20.9489 ^{.4292}
21-5	168 23 29.46	3 58 08.13	16 28.90	60 29.427	L 21 09.3781 ^{12.4261}
22-0	175 49 25.41	3 28 59.47	16 33.69	60 47.019	U 21 21.8042 ^{.4254}
22-5	183 19 06.26	2 56 00.97	16 37.50	61 00.992	L 22 10.2296 ^{.4271}
23-0	190 51 34.43	2 19 46.01	16 40.18	61 10.811	U 22 22.6567 ^{.4314}
23-5	198 25 45.72	+1 40 54.80	16 41.61	61 16.062	L 23 11.0881 ^{.4383}
24-0	206 00 31.49	+1 00 13.10	16 41.72	61 16.484	U 23 23.5264 ^{12.4475}
					L 24 11.9739

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Apr. 24.0	206 00 31.49	+1 00 13.10	16 41.72	61 16.484 - 4.493	L 24 11.9739 ^d 12.4584 ^h
24.5	213 34 41.16	+0 18 30.33	16 40.50	61 11.991 9.309	... ..
25.0	221 07 04.91	-0 23 22.57	16 37.96	61 02.682 13.845	U 25 00.4323 ...
25.5	228 36 36.24	1 04 35.37	16 34.19	60 48.837 17.948	L 25 12.9028 .4705
26.0	236 02 14.34	1 44 20.72	16 29.30	60 30.889 21.486	U 26 01.3855 .4827
26.5	243 23 06.09	-2 21 55.92	16 23.45	60 09.403 -24.372	L 26 13.8794 .4939
27.0	250 38 27.43	2 56 44.24	16 16.81	59 45.031 26.558	U 27 02.3824 12.5030
27.5	257 47 44.26	3 28 15.66	16 09.57	59 18.473 28.033	L 27 14.8909 .5085
28.0	264 50 32.68	3 56 07.12	16 01.93	58 50.440 28.818	U 28 03.4004 .5095
28.5	271 46 38.86	4 20 02.29	15 54.08	58 21.622 28.961	L 28 15.9061 .5057
29.0	278 35 58.40	-4 39 51.00	15 46.19	57 52.661 -28.530	U 29 04.4030 .4969
29.5	285 18 35.41	4 55 28.42	15 38.42	57 24.131 27.600	L 29 16.8870 12.4840
30.0	291 54 41.48	5 06 54.27	15 30.90	56 56.531 26.251	U 30 05.3547 .4677
30.5	298 24 34.43	5 14 11.84	15 23.75	56 30.280 24.566	L 30 17.8041 .4494
May 1.0	304 48 37.15	5 17 27.24	15 17.05	56 05.714 22.620	U 1 06.2344 .4303
1.5	311 07 16.46	-5 16 48.70	15 10.89	55 43.094 -20.484	L 1 18.6458 12.3934
2.0	317 21 02.03	5 12 25.97	15 05.31	55 22.610 18.222	U 2 07.0392 .3770
2.5	323 30 25.45	5 04 29.89	15 00.35	55 04.388 15.889	L 2 19.4162 .3626
3.0	329 35 59.38	4 53 12.12	14 56.02	54 48.499 13.533	U 3 07.7788 .3504
3.5	335 38 16.87	4 38 44.86	14 52.33	54 34.966 11.192	L 3 20.1292 .3405
4.0	341 37 50.77	-4 21 20.86	14 49.28	54 23.774 -8.904	U 4 08.4697 12.3328
4.5	347 35 13.24	4 01 13.29	14 46.86	54 14.870 6.691	L 4 20.8025 .3276
5.0	353 30 55.36	3 38 35.82	14 45.03	54 08.179 4.577	U 5 09.1301 .3245
5.5	359 25 26.86	3 13 42.66	14 43.79	54 03.602 2.576	L 5 21.4546 .3239
6.0	5 19 15.88	2 46 48.65	14 43.08	54 01.026 -0.699	U 6 09.7785 .3253
6.5	11 12 48.87	-2 18 09.35	14 42.89	54 00.327 +1.050	L 6 22.1038 12.3291
7.0	17 06 30.43	1 48 01.09	14 43.18	54 01.377 2.669	U 7 10.4329 .3347
7.5	23 00 43.39	1 16 41.05	14 43.91	54 04.046 4.161	L 7 22.7676 .3426
8.0	28 55 48.73	0 44 27.26	14 45.04	54 08.207 5.534	U 8 11.1102 .3523
8.5	34 52 05.71	-0 11 38.62	14 46.55	54 13.741 6.796	L 8 23.4625 .3638
9.0	40 49 51.94	+0 21 25.15	14 48.40	54 20.537 +7.963	U 9 11.8263 12.3767
9.5	46 49 23.55	0 54 23.61	14 50.57	54 28.500 9.045	... ..
10.0	52 50 55.37	1 26 55.72	14 53.03	54 37.545 10.062	L 10 00.2030 ...
10.5	58 54 41.10	1 58 39.95	14 55.77	54 47.607 11.027	U 10 12.5939 .3909
11.0	65 00 53.57	2 29 14.54	14 58.78	54 58.634 11.958	L 11 00.9994 .4055
11.5	71 09 44.89	+2 58 17.64	15 02.04	55 10.592 +12.868	U 11 13.4196 .4202
12.0	77 21 26.71	3 25 27.58	15 05.54	55 23.460 13.769	L 12 01.8538 12.4342
12.5	83 36 10.36	3 50 23.08	15 09.29	55 37.229 14.666	U 12 14.3003 .4465
13.0	89 54 07.03	4 12 43.50	15 13.29	55 51.895 15.561	L 13 02.7569 .4566
13.5	96 15 27.85	4 32 09.09	15 17.53	56 07.456 16.451	U 13 15.2204 .4635
14.0	102 40 23.90	+4 48 21.23	15 22.01	56 23.907 +17.321	L 14 03.6874 12.4671
14.5	109 09 06.19	5 01 02.67	15 26.73	56 41.228 18.153	U 14 16.1545 .4637
15.0	115 41 45.47	5 09 57.79	15 31.68	56 59.381 18.919	L 15 04.6182 .4579
15.5	122 18 31.99	5 14 52.94	15 36.83	57 18.300 19.582	U 15 17.0761 .4500
16.0	128 59 35.16	5 15 36.75	15 42.17	57 37.882 20.098	L 16 05.5261 .4412
16.5	135 45 03.02	+5 12 00.46	15 47.64	57 57.980 +20.415	U 16 17.9673 12.4324
17.0	142 35 01.68	+5 03 58.44	15 53.20	58 18.395	L 17 06.3997

MOON, 1967
FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
May 17.0	142° 35' 01".68	+5° 03' 58".44	15' 53".20	58' 18".395	L 17 06.3997 ^d 12.4241 ^h
17.5	149 29 34.61	4 51 28.62	15 58.78	58 38.872 +20.477	U 17 18.8238 .4174
18.0	156 28 41.88	4 34 33.04	16 04.29	58 59.096 20.224	L 18 07.2412 .4124
18.5	163 32 19.33	4 13 18.39	16 09.63	59 18.697 19.601	U 18 19.6536 .4098
19.0	170 40 17.84	3 47 56.50	16 14.69	59 37.249 18.552	L 19 08.0634 .4098
19.5	177 52 22.54	+3 18 44.83	16 19.33	59 54.290 17.041	U 19 20.4732 12.4125
20.0	185 08 12.25	2 46 06.68	16 23.43	60 09.331 +15.041	L 20 08.8857 .4182
20.5	192 27 19.14	2 10 31.25	16 26.85	60 21.879 12.548	U 20 21.3039 .4265
21.0	199 49 08.59	1 32 33.32	16 29.46	60 31.468 9.589	L 21 09.7304 .4375
21.5	207 12 59.52	0 52 52.62	16 31.15	60 37.682 6.214	U 21 22.1679 .4505
22.0	214 38 05.02	+0 12 12.73	16 31.83	60 40.187 +2.505	L 22 10.6184 12.4651
22.5	222 03 33.45	-0 28 40.28	16 31.44	60 38.758 -1.429	U 22 23.0835 .4803
23.0	229 28 29.87	1 08 59.55	16 29.96	60 33.298 5.460	L 23 11.5638 .4945
23.5	236 51 57.80	1 47 59.26	16 27.38	60 23.849 9.449	... ..
24.0	244 13 01.19	2 24 56.37	16 23.77	60 10.592 13.257	U 24 00.0583 .5068
24.5	251 30 46.43	-2 59 12.24	16 19.21	59 53.841 16.751	L 24 12.5651 12.5153
25.0	258 44 24.26	3 30 13.87	16 13.81	59 34.023 -19.818	U 25 01.0804 .5190
25.5	265 53 11.52	3 57 34.73	16 07.71	59 11.653 22.370	L 25 13.5994 .5170
26.0	272 56 32.47	4 20 55.08	16 01.08	58 47.303 24.350	U 26 02.1164 .5092
26.5	279 53 59.75	4 40 01.95	15 54.07	58 21.575 25.728	L 26 14.6256 .4963
27.0	286 45 14.84	-4 54 48.62	15 46.85	57 55.073 26.502	U 27 03.1219 12.4795
27.5	293 30 08.14	5 05 13.94	15 39.58	57 28.378 26.695	L 27 15.6014 .4600
28.0	300 08 38.69	5 11 21.46	15 32.40	57 02.030 26.348	U 28 04.0614 .4393
28.5	306 40 53.49	5 13 18.47	15 25.45	56 36.516 25.514	L 28 16.5007 .4188
29.0	313 07 06.71	5 11 15.14	15 18.84	56 12.261 24.255	U 29 04.9195 .3993
29.5	319 27 38.74	-5 05 23.70	15 12.67	55 49.625 22.636	L 29 17.3188 12.3815
30.0	325 42 55.14	4 55 57.76	15 07.02	55 28.901 -20.724	U 30 05.7003 .3659
30.5	331 53 25.63	4 43 11.81	15 01.96	55 10.321 18.580	L 30 18.0662 .3526
31.0	337 59 43.15	4 27 20.75	14 57.53	54 54.056 16.265	U 31 06.4188 .3420
31.5	344 02 22.93	4 08 39.72	14 53.76	54 40.222 13.834	L 31 18.7608 .3339
June 1.0	350 02 01.68	-3 47 23.90	14 50.67	54 28.887 11.335	U 1 07.0947 12.3283
1.5	355 59 16.89	3 23 48.49	14 48.27	54 20.074 -8.813	L 1 19.4230 .3252
2.0	1 54 46.14	2 58 08.74	14 46.55	54 13.765 6.309	U 2 07.7482 .3246
2.5	7 49 06.58	2 30 40.04	14 45.50	54 09.909 3.856	L 2 20.0728 .3264
3.0	13 42 54.41	2 01 38.04	14 45.10	54 08.426 -1.483	U 3 08.3992 .3305
3.5	19 36 44.47	-1 31 18.81	14 45.31	54 09.204 +0.778	L 3 20.7297 12.3369
4.0	25 31 09.82	0 59 58.99	14 46.10	54 12.113 +2.909	U 4 09.0666 .3455
4.5	31 26 41.43	-0 27 55.94	14 47.44	54 17.002 4.889	L 4 21.4121 .3561
5.0	37 23 47.86	+0 04 32.15	14 49.26	54 23.704 6.702	U 5 09.7682 .3687
5.5	43 22 54.96	0 37 06.22	14 51.53	54 32.039 8.335	L 5 22.1369 .3829
6.0	49 24 25.68	+1 09 26.25	14 54.20	54 41.822 9.783	U 6 10.5198 12.3981
6.5	55 28 39.86	1 41 11.35	14 57.21	54 52.861 +11.039	L 6 22.9179 .4138
7.0	61 35 54.12	2 11 59.83	15 00.50	55 04.966 12.105	U 7 11.3317 .4294
7.5	67 46 21.75	2 41 29.44	15 04.04	55 17.950 12.984	L 7 23.7611 .4439
8.0	74 00 12.76	3 09 17.52	15 07.77	55 31.636 13.686	... ..
8.5	80 17 33.97	+3 35 01.45	15 11.65	55 45.859 14.223	U 8 12.2050 12.4562
9.0	86 38 29.14	+3 58 18.93	15 15.63	56 00.470 +14.611	L 9 00.6612

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
June 9-0	86° 38' 29.14	+3° 58' 18.93	15' 15.63	56' 00.470	L 9 00.6612 ^{d h}
9-5	93 02 59.23	4 18 48.47	15 19.68	56 15.338 +14.868	U 9 13.1269 ^h 12.4657
10-0	99 31 02.81	4 36 09.84	15 23.77	56 30.351 15.013	L 10 01.5984 4715
10-5	106 02 36.38	4 50 04.54	15 27.87	56 45.419 15.068	U 10 14.0716 4732
11-0	112 37 34.87	5 00 16.24	15 31.97	57 00.466 15.047	L 11 02.5427 4711
11-5	119 15 52.15	+5 06 31.25	15 36.05	57 15.433 14.967	U 11 15.0081 4654
12-0	125 57 21.42	5 08 38.85	15 40.09	57 30.271 +14.838	L 12 03.4652 ^h 12.4571
12-5	132 41 55.68	5 06 31.65	15 44.09	57 44.937 14.666	U 12 15.9121 4469
13-0	139 29 28.09	5 00 05.87	15 48.02	57 59.382 14.445	L 13 04.3482 4361
13-5	146 19 52.15	4 49 21.58	15 51.88	58 13.551 14.169	U 13 16.7737 4255
14-0	153 13 01.80	+4 34 22.81	15 55.65	58 27.372 13.821	L 14 05.1896 4159
14-5	160 08 51.35	4 15 17.75	15 59.29	58 40.748 +13.376	U 14 17.5976 ^h 12.4080
15-0	167 07 15.25	3 52 18.78	16 02.78	58 53.555 12.807	L 15 05.9999 4023
15-5	174 08 07.62	3 25 42.54	16 06.07	59 05.637 12.082	U 15 18.3989 3990
16-0	181 11 21.80	2 55 49.87	16 09.12	59 16.803 11.166	L 16 06.7974 3985
16-5	188 16 49.60	+2 23 05.75	16 11.85	59 26.831 10.028	U 16 19.1984 4010
17-0	195 24 20.67	1 47 59.09	16 14.20	59 35.473 +8.642	L 17 07.6047 ^h 12.4063
17-5	202 33 41.71	1 11 02.41	16 16.11	59 42.463 6.990	U 17 20.0193 4146
18-0	209 44 35.86	+0 32 51.37	16 17.49	59 47.530 5.067	L 18 08.4448 4255
18-5	216 56 42.16	-0 05 55.91	16 18.27	59 50.411 2.881	U 18 20.8836 4388
19-0	224 09 35.28	-0 44 39.69	16 18.40	59 50.870 +0.459	L 19 09.3374 4538
19-5	231 22 45.44	1 22 39.62	16 17.81	59 48.715 -2.155	U 19 21.8070 ^h 12.4696
20-0	238 35 38.79	1 59 15.93	16 16.47	59 43.813 4.902	L 20 10.2922 4852
20-5	245 47 38.03	2 33 50.63	16 14.38	59 36.109 7.704	U 20 22.7911 4989
21-0	252 58 03.39	3 05 48.72	16 11.52	59 25.627 10.482	L 21 11.3006 5095
21-5	260 06 13.93	-3 34 39.30	16 07.94	59 12.482 13.145	U 21 23.8161 ^h 12.5157
22-0	267 11 29.04	3 59 56.50	16 03.69	58 56.875 -15.607	... ... 12.5157
22-5	274 13 09.97	4 21 20.05	15 58.84	58 39.087 17.788	L 22 12.3318 ...
23-0	281 10 41.46	4 38 35.64	15 53.49	58 19.467 19.620	U 23 00.8420 5102
23-5	288 03 33.05	4 51 34.88	15 47.76	57 58.415 21.052	L 23 13.3412 4992
24-0	294 51 20.32	-5 00 14.99	15 41.75	57 36.368 22.047	U 24 01.8249 4837
24-5	301 33 45.66	5 04 38.27	15 35.60	57 13.778 -22.590	L 24 14.2899 ^h 12.4650
25-0	308 10 38.76	5 04 51.36	15 29.42	56 51.101 22.677	U 25 02.7348 4449
25-5	314 41 56.81	5 01 04.45	15 23.34	56 28.775 22.326	L 25 15.1591 4243
26-0	321 07 44.28	4 53 30.46	15 17.46	56 07.214 21.561	U 26 03.5636 4045
26-5	327 28 12.52	-4 42 24.30	15 11.90	55 46.797 20.417	L 26 15.9499 3863
27-0	333 43 39.18	4 28 02.13	15 06.74	55 27.862 -18.935	U 27 04.3201 ^h 12.3702
27-5	339 54 27.45	4 10 40.84	15 02.07	55 10.700 17.162	L 27 16.6766 3565
28-0	346 01 05.29	3 50 37.66	14 57.94	54 55.558 15.142	U 28 05.0218 3452
28-5	352 04 04.60	3 28 09.75	14 54.42	54 42.635 12.923	L 28 17.3585 3367
29-0	358 04 00.44	-3 03 34.14	14 51.55	54 32.084 10.551	U 29 05.6891 3306
29-5	4 01 30.23	2 37 07.58	14 49.35	54 24.015 -8.069	L 29 18.0162 ^h 12.3271
30-0	9 57 13.06	2 09 06.59	14 47.84	54 18.496 5.519	U 30 06.3424 3262
30-5	15 51 48.99	1 39 47.51	14 47.04	54 15.556 2.940	L 30 18.6702 3278
July 1-0	21 45 58.44	1 09 26.70	14 46.94	54 15.183 -0.373	U 1 07.0020 3318
1-5	27 40 21.55	-0 38 20.64	14 47.53	54 17.332 +2.149	L 1 19.3403 3383
2-0	33 35 37.63	-0 06 46.17	14 48.78	54 21.919 +4.587	U 2 07.6873 ^h 12.3470

MOON, 1967
FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
July 1-0	21 45 58.44	-1 09 26.70	14 46.94	54 15.183 + 2.149	U 1 07.0020 ^{d h} 12.3383 ^h
1-5	27 40 21.55	0 38 20.64	14 47.53	54 17.332 + 4.587	L 1 19.3403 3470
2-0	33 35 37.63	-0 06 46.17	14 48.78	54 21.919 + 6.911	U 2 07.6873 3580
2-5	39 32 24.60	+0 24 59.34	14 50.66	54 28.830 + 9.086	L 2 20.0453 3709
3-0	45 31 18.35	0 56 37.82	14 53.13	54 37.916 + 11.081	U 3 08.4162 3857
3-5	51 32 52.28	+1 27 50.36	14 56.15	54 48.997 + 12.868	L 3 20.8019 4016
4-0	57 37 36.61	1 58 17.12	14 59.66	55 01.865 + 14.420	U 4 09.2035 4182
4-5	63 45 57.89	2 27 37.33	15 03.59	55 16.285 + 15.712	L 4 21.6217 4347
5-0	69 58 18.37	2 55 29.36	15 07.87	55 31.997 + 16.727	U 5 10.0564 4501
5-5	76 14 55.60	3 21 30.89	15 12.43	55 48.724 + 17.450	L 5 22.5065 4632
6-0	82 36 01.88	+3 45 19.22	15 17.18	56 06.174 + 17.873	U 6 10.9697 4732
6-5	89 01 44.02	4 06 31.67	15 22.05	56 24.047 + 17.997	L 6 23.4429 4793
7-0	95 32 03.12	4 24 46.12	15 26.95	56 42.044 + 17.832	U 7 11.9222 4811
7-5	102 06 54.62	4 39 41.61	15 31.81	56 59.876 + 17.392	... ..
8-0	108 46 08.52	4 50 59.01	15 36.55	57 17.268 + 16.703	L 8 00.4033 4785
8-5	115 29 29.84	+4 58 21.79	15 41.10	57 33.971 + 15.798	U 8 12.8818 4722
9-0	122 16 39.36	5 01 36.65	15 45.40	57 49.769 + 14.711	L 9 01.3540 4629
9-5	129 07 14.48	5 00 34.18	15 49.41	58 04.480 + 13.485	U 9 13.8169 4518
10-0	136 00 50.32	4 55 09.39	15 53.09	58 17.965 + 12.160	L 10 02.2687 4400
10-5	142 57 00.84	4 45 22.05	15 56.40	58 30.125 + 10.777	U 10 14.7087 4283
11-0	149 55 19.99	+4 31 16.87	15 59.33	58 40.902 + 9.369	L 11 03.1370 42179
11-5	156 55 22.76	4 13 03.54	16 01.89	58 50.271 + 7.965	U 11 15.5549 4090
12-0	163 56 46.08	3 50 56.57	16 04.06	58 58.236 + 6.588	L 12 03.9639 4026
12-5	170 59 09.44	3 25 14.94	16 05.85	59 04.824 + 5.247	U 12 16.3665 3986
13-0	178 02 15.25	2 56 21.73	16 07.28	59 10.071 + 3.946	L 13 04.7651 3973
13-5	185 05 48.89	+2 24 43.55	16 08.36	59 14.017 + 2.680	U 13 17.1624 3991
14-0	192 09 38.52	1 50 50.01	16 09.09	59 16.697 + 1.437	L 14 05.5615 4036
14-5	199 13 34.58	1 15 13.14	16 09.48	59 18.134 + 0.201	U 14 17.9651 4111
15-0	206 17 29.09	0 38 26.75	16 09.53	59 18.335 - 1.047	L 15 06.3762 4210
15-5	213 21 14.87	+0 01 05.88	16 09.25	59 17.288 - 2.324	U 15 18.7972 4332
16-0	220 24 44.63	-0 36 13.88	16 08.61	59 14.964 - 3.643	L 16 07.2304 42470
16-5	227 27 50.14	1 12 56.97	16 07.62	59 11.321 + 5.013	U 16 19.6774 4617
17-0	234 30 21.40	1 48 28.54	16 06.26	59 06.308 + 6.436	L 17 08.1391 4761
17-5	241 32 06.09	2 22 15.12	16 04.50	58 59.872 + 7.904	U 17 20.6152 4889
18-0	248 32 49.17	2 53 45.29	16 02.35	58 51.968 + 9.397	L 18 09.1041 4988
18-5	255 32 12.77	-3 22 30.39	15 59.79	58 42.571 - 10.892	U 18 21.6029 5046
19-0	262 29 56.34	3 48 05.15	15 56.82	58 31.679 + 12.353	L 19 10.1075 5053
19-5	269 25 37.15	4 10 08.22	15 53.46	58 19.326 + 13.743	U 19 22.6128 5007
20-0	276 18 50.98	4 28 22.70	15 49.71	58 05.583 + 15.018	L 20 11.1135 4911
20-5	283 09 13.07	4 42 36.35	15 45.62	57 50.565 + 16.134	U 20 23.6046 4772
21-0	289 56 19.19	-4 52 41.79	15 41.23	57 34.431 - 17.050	... ..
21-5	296 39 46.78	4 58 36.40	15 36.58	57 17.381 + 17.730	L 21 12.0818 4603
22-0	303 19 16.05	5 00 22.10	15 31.75	56 59.651 + 18.145	U 22 00.5421 4417
22-5	309 54 30.93	4 58 04.92	15 26.81	56 41.506 + 18.268	L 22 12.9838 4225
23-0	316 25 19.95	4 51 54.49	15 21.83	56 23.238 + 18.091	U 23 01.4063 4039
23-5	322 51 36.77	-4 42 03.42	15 16.90	56 05.147 - 17.605	L 23 13.8102 42367
24-0	329 13 20.58	-4 28 46.67	15 12.10	55 47.542	U 24 02.1969

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit	
July 24·0	329° 13' 20" 58	-4° 28' 46" 67	15' 12" 10	55' 47" 542 -16" 813	U 24 02·1969 ^h L 24 14·5681 ^{12·3712}	
24·5	335 30 36·27	4 12 20·94	15 07·52	55 30·729 15·727	U 25 02·9260 ^{·3579} L 25 15·2730 ^{·3470}	
25·0	341 43 34·32	3 53 04·03	15 03·24	55 15·002 14·364	U 26 03·6115 ^{·3385} L 26 15·9440 ^{·3325}	
25·5	347 52 30·60	3 31 14·41	14 59·32	55 00·638 12·744	U 27 04·2729 ^{12·3289} L 27 16·6008 ^{·3279}	
26·0	353 57 45·97	3 07 10·74	14 55·85	54 47·894 10·893	U 28 04·9300 ^{·3292} L 28 17·2629 ^{·3329}	
26·5	359 59 45·81	-2 41 11·63	14 52·88	54 37·001 -8·839	U 29 05·6020 ^{12·3475} L 29 17·9495 ^{·3581}	
27·0	5 58 59·55	2 13 35·40	14 50·48	54 28·162 6·615	U 30 06·3076 ^{·3707} L 30 18·6783 ^{·3852}	
27·5	11 56 00·04	1 44 39·99	14 48·67	54 21·547 4·251	U 31 07·0635 ^{·4009} L 31 19·4644 ^{12·4175}	
28·0	17 51 22·99	1 14 42·96	14 47·52	54 17·296 -1·781	U 1 07·8819 ^{12·4175} L 1 20·3159 ^{·4340}	
28·5	23 45 46·43	0 44 01·48	14 47·03	54 15·515 +0·760	U 2 08·7656 ^{·4497} L 2 21·2289 ^{·4633}	
29·0	29 39 50·05	-0 12 52·55	14 47·24	54 16·275 +3·336	U 3 09·7031 ^{12·4812} L 3 22·1843 ^{·4841}	
29·5	35 34 14·69	+0 18 26·92	14 48·15	54 19·611 5·911	U 4 10·6684 ^{·4826} L 4 23·1510 ^{·4774}	
30·0	41 29 41·70	0 49 39·91	14 49·76	54 25·522 8·446	U 5 11·6284 ^{·4691} L 6 00·0975 ^{12·4588}	
30·5	47 26 52·32	1 20 29·07	14 52·06	54 33·968 10·901	U 6 12·5563 ^{·4476} L 7 01·0039 ^{·4364}	
31·0	53 26 27·00	1 50 36·56	14 55·03	54 44·869 13·232	U 7 13·4403 ^{·4264} L 8 01·8667 ^{12·4178}	
Aug. 31·5	59 29 04·76	+2 19 43·84	14 58·63	54 58·101 +15·396	U 8 14·2845 ^{·4114} L 9 02·6959 ^{·4076}	
1·0	65 35 22·32	2 47 31·61	15 02·83	55 13·497 17·351	U 9 15·1035 ^{·4062} L 10 03·5097 ^{·4078}	
1·5	71 45 53·38	3 13 39·73	15 07·56	55 30·848 19·045	U 10 15·9175 ^{12·4121} L 11 04·3296 ^{·4188}	
2·0	78 01 07·63	3 37 47·25	15 12·74	55 49·893 20·438	U 11 16·7484 ^{·4280} L 12 05·1764 ^{·4389}	
2·5	84 21 29·97	3 59 32·60	15 18·31	56 10·331 21·484	U 12 17·6153 ^{·4511} L 13 06·0664 ^{12·4636}	
3·0	90 47 19·48	+4 18 33·88	15 24·17	56 31·815 +22·145	U 13 18·5300 ^{·4755} L 14 07·0055 ^{·4855}	
3·5	97 18 48·68	4 34 29·29	15 30·20	56 53·960 22·391	U 14 19·4910 ^{·4926} L 15 07·9836 ^{·4957}	
4·0	103 56 02·68	4 46 57·77	15 36·30	57 16·351 22·197		
4·5	110 38 58·73	4 55 39·70	15 42·35	57 38·548 21·558		
5·0	117 27 25·91	5 00 17·83	15 48·22	58 00·106 20·477		
5·5	124 21 05·18	+5 00 38·19	15 53·80	58 20·583 +18·979		
6·0	131 19 29·93	4 56 31·01	15 58·97	58 39·562 17·101		
6·5	138 22 06·83	4 47 51·57	16 03·63	58 56·663 14·904		
7·0	145 28 17·12	4 34 40·93	16 07·69	59 11·567 12·455		
7·5	152 37 18·27	4 17 06·27	16 11·08	59 24·022 9·834		
8·0	159 48 25·77	+3 55 21·07	16 13·76	59 33·856 +7·127		
8·5	167 00 55·03	3 29 44·86	16 15·70	59 40·983 4·420		
9·0	174 14 03·19	3 00 42·73	16 16·91	59 45·403 +1·788		
9·5	181 27 10·64	2 28 44·44	16 17·39	59 47·191 -0·699		
10·0	188 39 42·22	1 54 23·50	16 17·20	59 46·492 2·990		
10·5	195 51 08·01	+1 18 16·02	16 16·39	59 43·502 -5·045		
11·0	203 01 03·60	0 40 59·61	16 15·02	59 38·457 6·849		
11·5	210 09 10·09	+0 03 12·32	16 13·15	59 31·608 8·396		
12·0	217 15 13·55	-0 34 28·30	16 10·86	59 23·212 9·696		
12·5	224 19 04·41	1 11 26·01	16 08·22	59 13·516 10·770		
13·0	231 20 36·49	-1 47 06·50	16 05·29	59 02·746 -11·646		
13·5	238 19 46·04	2 20 57·95	16 02·11	58 51·100 12·354		
14·0	245 16 30·81	2 52 31·35	15 58·75	58 38·746 12·928		
14·5	252 10 49·06	3 21 20·84	15 55·23	58 25·818 13·396		
15·0	259 02 38·90	3 47 03·96	15 51·58	58 12·422 13·785		
15·5	265 51 57·63	-4 09 21·75	15 47·82	57 58·637 -14·111		
16·0	272 38 41·40	-4 27 58·96	15 43·98	57 44·526		

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Aug. 16.0	272° 38' 41.40	-4° 27' 58.96	15' 43.98	57' 44.526	L 16 08.9736 ^{d h}
16.5	279 22 45.02	4 42 44.11	15 40.05	57 30.135	U 16 21.4618 ^h
17.0	286 04 02.02	4 53 29.52	15 36.07	57 15.509	L 17 09.9397
17.5	292 42 24.90	5 00 11.32	15 32.03	57 00.693	U 17 22.4039
18.0	299 17 45.52	5 02 49.34	15 27.96	56 45.739	L 18 10.8521
18.5	305 49 55.68	-5 01 26.99	15 23.87	56 30.714	U 18 23.2830
19.0	312 18 47.69	4 56 11.02	15 19.78	56 15.703	L 19 11.6963
19.5	318 44 15.08	4 47 11.20	15 15.72	56 00.807	...
20.0	325 06 13.18	4 34 39.98	15 11.72	55 46.150	U 20 00.0928
20.5	331 24 39.76	4 18 52.08	15 07.83	55 31.874	L 20 12.4736
21.0	337 39 35.51	-4 00 04.00	15 04.09	55 18.142	U 21 00.8404
21.5	343 51 04.44	3 38 33.65	15 00.55	55 05.127	L 21 13.1954
22.0	349 59 14.17	3 14 39.83	14 57.25	54 53.017	U 22 01.5405
22.5	356 04 16.07	2 48 41.94	14 54.25	54 42.005	L 22 13.8781
23.0	2 06 25.35	2 20 59.54	14 51.60	54 32.289	U 23 02.2105
23.5	8 06 00.97	-1 51 52.15	14 49.36	54 24.062	L 23 14.5399
24.0	14 03 25.54	1 21 39.03	14 47.58	54 17.514	U 24 02.8686
24.5	19 59 05.09	0 50 39.06	14 46.30	54 12.823	L 24 15.1989
25.0	25 53 28.80	-0 19 10.66	14 45.57	54 10.155	U 25 03.5329
25.5	31 47 08.71	+0 12 28.17	14 45.44	54 09.657	L 25 15.8729
26.0	37 40 39.36	+0 43 59.80	14 45.93	54 11.457	U 26 04.2210
26.5	43 34 37.38	1 15 06.85	14 47.07	54 15.657	L 26 16.5792
27.0	49 29 41.05	1 45 32.08	14 48.89	54 22.331	U 27 04.9493
27.5	55 26 29.84	2 14 58.16	14 51.39	54 31.523	L 27 17.3330
28.0	61 25 43.80	2 43 07.56	14 54.58	54 43.238	U 28 05.7313
28.5	67 28 03.01	+3 09 42.34	14 58.45	54 57.442	L 28 18.1452
29.0	73 34 06.78	3 34 24.09	15 02.98	55 14.056	U 29 06.5744
29.5	79 44 32.84	3 56 53.82	15 08.13	55 32.949	L 29 19.0183
30.0	85 59 56.42	4 16 52.01	15 13.85	55 53.935	U 30 07.4753
30.5	92 20 49.22	4 33 58.70	15 20.07	56 16.766	L 30 19.9426
31.0	98 47 38.27	+4 47 53.81	15 26.70	56 41.133	U 31 08.4172
31.5	105 20 44.73	4 58 17.56	15 33.66	57 06.658	L 31 20.8953
Sept. 1.0	112 00 22.71	5 04 51.04	15 40.81	57 32.904	U 1 09.3732
1.5	118 46 38.17	5 07 17.01	15 48.02	57 59.369	L 1 21.8475
2.0	125 39 27.91	5 05 20.89	15 55.14	58 25.504	U 2 10.3155
2.5	132 38 39.00	+4 58 51.76	16 02.01	58 50.726	L 2 22.7752
3.0	139 43 48.41	4 47 43.51	16 08.47	59 14.434	U 3 11.2259
3.5	146 54 23.32	4 31 55.87	16 14.36	59 36.037	L 3 23.6675
4.0	154 09 41.88	4 11 35.28	16 19.52	59 54.982	...
4.5	161 28 54.53	3 46 55.46	16 23.82	60 10.781	U 4 12.1009
5.0	168 51 05.89	+3 18 17.50	16 27.16	60 23.041	L 5 00.5276
5.5	176 15 16.96	2 46 09.60	16 29.46	60 31.489	U 5 12.9495
6.0	183 40 27.54	2 11 06.19	16 30.69	60 35.982	L 6 01.3689
6.5	191 05 38.69	1 33 46.70	16 30.83	60 36.519	U 6 13.7885
7.0	198 29 54.86	0 54 53.98	16 29.94	60 33.231	L 7 02.2108
7.5	205 52 25.77	+0 15 12.63	16 28.07	60 26.373	U 7 14.6382
8.0	213 12 27.72	-0 24 32.76	16 25.33	60 16.298	L 8 03.0731

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Sept. 8.0	213 12 27.72	-0 24 32.76	16 25.33	60 16.298	L 8 03.0731 ^d 12.4444 ^h
8.5	220 29 24.39	1 03 39.13	16 21.82	60 03.431 -12.867	U 8 15.5175
9.0	227 42 47.12	1 41 26.24	16 17.68	59 48.240 15.191	L 9 03.9725
9.5	234 52 14.73	2 17 17.62	16 13.04	59 31.210 17.030	U 9 16.4389
10.0	241 57 32.94	2 50 41.22	16 08.03	59 12.813 18.397	L 10 04.9160
10.5	248 58 33.65	-3 21 09.69	16 02.77	58 53.494 19.319	U 10 17.4026
11.0	255 55 13.86	3 48 20.48	15 57.36	58 33.654 -19.840	L 11 05.8960
11.5	262 47 34.73	4 11 55.69	15 51.91	58 13.639 20.015	U 11 18.3926
12.0	269 35 40.55	4 31 41.87	15 46.49	57 53.740 19.899	L 12 06.8882
12.5	276 19 37.80	4 47 29.65	15 41.16	57 34.187 19.553	U 12 19.3784
13.0	282 59 34.37	-4 59 13.45	15 35.97	57 15.160 19.027	L 13 07.8592
13.5	289 35 38.87	5 06 51.17	15 30.97	56 56.786 -18.374	U 13 20.3270
14.0	296 08 00.11	5 10 23.84	15 26.17	56 39.155 17.631	L 14 08.7795
14.5	302 36 46.77	5 09 55.38	15 21.58	56 22.321 16.834	U 14 21.2151
15.0	309 02 07.17	5 05 32.34	15 17.22	56 06.315 16.006	L 15 09.6334
15.5	315 24 09.20	-4 57 23.69	15 13.09	55 51.150 15.165	U 15 22.0348
16.0	321 43 00.39	4 45 40.53	15 09.19	55 36.830 -14.320	L 16 10.4205
16.5	327 58 48.02	4 30 35.97	15 05.52	55 23.360 13.470	U 16 22.7918
17.0	334 11 39.36	4 12 24.81	15 02.08	55 10.743 12.617	L 17 11.1507
17.5	340 21 41.93	3 51 23.34	14 58.88	54 58.996 11.747	U 17 23.4992
18.0	346 29 03.81	-3 27 49.10	14 55.92	54 48.146 10.850	L 18 11.8395
18.5	352 33 53.98	3 02 00.60	14 53.22	54 38.233 -9.913	... ...
19.0	358 36 22.59	2 34 17.09	14 50.79	54 29.317 8.916	U 19 00.1736
19.5	4 36 41.29	2 04 58.24	14 48.65	54 21.471 7.846	L 19 12.5037
20.0	10 35 03.45	1 34 24.01	14 46.83	54 14.788 6.683	U 20 00.8320
20.5	16 31 44.43	-1 02 54.35	14 45.36	54 09.370 5.418	L 20 13.1606
21.0	22 27 01.69	-0 30 49.05	14 44.26	54 05.336 -4.034	U 21 01.4916
21.5	28 21 14.95	+0 01 32.36	14 43.57	54 02.810 2.526	L 21 13.8270
22.0	34 14 46.23	0 33 50.74	14 43.33	54 01.923 -0.887	U 22 02.1688
22.5	40 07 59.88	1 05 47.40	14 43.57	54 02.808 +0.885	L 22 14.5188
23.0	46 01 22.55	+1 37 04.06	14 44.33	54 05.595 2.787	U 23 02.8788
23.5	51 55 23.03	2 07 22.86	14 45.64	54 10.409 +4.814	L 23 15.2502
24.0	57 50 32.18	2 36 26.28	14 47.53	54 17.361 6.952	U 24 03.6344
24.5	63 47 22.61	3 04 57.07	14 50.04	54 26.548 9.187	L 24 16.0321
25.0	69 46 28.45	3 29 38.09	14 53.17	54 38.041 11.493	U 25 04.4437
25.5	75 48 24.91	+3 53 12.27	14 56.94	54 51.885 13.844	L 25 16.8688
26.0	81 53 47.84	4 14 22.48	15 01.35	55 08.090 +16.205	U 26 05.3066
26.5	88 03 13.09	4 32 51.53	15 06.40	55 26.625 18.535	L 26 17.7552
27.0	94 17 15.81	4 48 22.14	15 12.07	55 47.405 20.780	U 27 06.2123
27.5	100 36 29.60	5 00 37.07	15 18.30	56 10.294 22.889	L 27 18.6750
28.0	107 01 25.50	+5 09 19.37	15 25.06	56 35.085 24.791	U 28 07.1403
28.5	113 32 30.91	5 14 12.68	15 32.25	57 01.502 +26.417	L 28 19.6050
29.0	120 10 08.32	5 15 01.82	15 39.80	57 29.191 27.689	U 29 08.0667
29.5	126 54 34.03	5 11 33.43	15 47.57	57 57.715 28.524	L 29 20.5231
30.0	133 45 56.82	5 03 36.87	15 55.43	58 26.557 28.842	U 30 08.9730
30.5	140 44 16.76	+4 51 05.20	16 03.21	58 55.127 28.570	L 30 21.4159
Oct. 1.0	147 49 24.12	+4 33 56.30	16 10.74	59 22.770 +27.643	U 1 09.8521

MOON, 1967
FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Oct. 1.0	147 49 24.12	+4 33 56.30	16 10.74	59 22.770 +26.020	U 1 09.8521 ^d 12.4305 ^h
1.5	155 00 58.64	4 12 13.96	16 17.83	59 48.790 23.687	L 1 22.2826 4263
2.0	162 18 29.29	3 46 08.84	16 24.28	60 12.477 20.660	U 2 10.7089 4242
2.5	169 41 14.47	3 15 59.18	16 29.91	60 33.137 17.002	L 2 23.1331 4245
3.0	177 08 22.88	2 42 11.09	16 34.54	60 50.139 12.806	U 3 11.5576 4272
3.5	184 38 54.98	+2 05 18.29	16 38.03	61 02.945 +8.212	L 3 23.9848 12.4325
4.0	192 11 45.08	1 26 01.28	16 40.27	61 11.157 +3.382	...
4.5	199 45 43.75	0 45 05.95	16 41.19	61 14.539 -1.502	U 4 12.4173 ...
5.0	207 19 40.53	+0 03 21.65	16 40.78	61 13.037 6.257	L 5 00.8576 4403
5.5	214 52 26.64	-0 38 20.93	16 39.08	61 06.780 10.712	U 5 13.3078 4502
6.0	222 22 57.51	-1 19 12.00	16 36.16	60 56.068 -14.720	L 6 01.7695 12.4744
6.5	229 50 14.90	1 58 24.75	16 32.15	60 41.348 18.173	U 6 14.2439 4867
7.0	237 13 28.54	2 35 17.03	16 27.20	60 23.175 20.997	L 7 02.7306 4979
7.5	244 31 57.15	3 09 12.56	16 21.48	60 02.178 23.163	U 7 15.2285 5066
8.0	251 45 08.98	3 39 41.63	16 15.17	59 39.015 24.675	L 8 03.7351 5114
8.5	258 52 41.68	-4 06 21.28	16 08.44	59 14.340 -25.567	U 8 16.2465 12.5117
9.0	265 54 21.88	4 28 55.10	16 01.48	58 48.773 25.894	L 9 04.7582 5069
9.5	272 50 04.33	4 47 12.67	15 54.42	58 22.879 25.728	U 9 17.2651 4973
10.0	279 39 50.94	5 01 08.92	15 47.41	57 57.151 25.144	L 10 05.7624 4837
10.5	286 23 49.59	5 10 43.33	15 40.56	57 32.007 24.223	U 10 18.2461 4670
11.0	293 02 13.02	-5 15 59.17	15 33.97	57 07.784 -23.038	L 11 06.7131 12.4486
11.5	299 35 17.66	5 17 02.81	15 27.69	56 44.746 21.662	U 11 19.1617 4295
12.0	306 03 22.66	5 14 03.12	15 21.79	56 23.084 20.155	L 12 07.5912 4107
12.5	312 26 48.91	5 07 10.96	15 16.30	56 02.929 18.570	U 12 20.0019 3932
13.0	318 45 58.34	4 56 38.80	15 11.24	55 44.359 16.952	L 13 08.3951 3772
13.5	325 01 13.22	-4 42 40.43	15 06.62	55 27.407 -15.333	U 13 20.7723 12.3632
14.0	331 12 55.70	4 25 30.73	15 02.44	55 12.074 13.740	L 14 09.1355 3515
14.5	337 21 27.46	4 05 25.50	14 58.70	54 58.334 12.192	U 14 21.4870 3420
15.0	343 27 09.40	3 42 41.40	14 55.38	54 46.142 10.698	L 15 09.8290 3348
15.5	349 30 21.58	3 17 35.79	14 52.46	54 35.444 9.262	U 15 22.1638 3299
16.0	355 31 23.06	-2 50 26.66	14 49.94	54 26.182 -7.881	L 16 10.4937 12.3271
16.5	1 30 32.04	2 21 32.60	14 47.79	54 18.301 6.552	U 16 22.8208 3266
17.0	7 28 05.90	1 51 12.64	14 46.01	54 11.749 5.259	L 17 11.1474 3281
17.5	13 24 21.38	1 19 46.21	14 44.57	54 06.490 3.991	U 17 23.4755 3317
18.0	19 19 34.78	0 47 32.99	14 43.48	54 02.499 2.731	L 18 11.8072 3372
18.5	25 14 02.16	-0 14 52.80	14 42.74	53 59.768 -1.462	...
19.0	31 07 59.62	+0 17 54.53	14 42.34	53 58.306 -0.164	U 19 00.1444 ...
19.5	37 01 43.54	0 50 29.27	14 42.30	53 58.142 +1.176	L 19 12.4890 12.3446
20.0	42 55 30.83	1 22 31.92	14 42.62	53 59.318 2.578	U 20 00.8425 3535
20.5	48 49 39.16	1 53 43.33	14 43.32	54 01.896 4.052	L 20 13.2066 3641
21.0	54 44 27.20	+2 23 44.74	14 44.42	54 05.948 +5.609	U 21 01.5825 3759
21.5	60 40 14.78	2 52 17.92	14 45.95	54 11.557 7.256	L 21 13.9708 12.3883
22.0	66 37 23.01	3 19 05.15	14 47.93	54 18.813 8.995	U 22 02.3721 4013
22.5	72 36 14.40	3 43 49.31	14 50.38	54 27.808 10.821	L 22 14.7860 4139
23.0	78 37 12.83	4 06 13.81	14 53.33	54 38.629 12.723	U 23 03.2118 4258
23.5	84 40 43.58	+4 26 02.68	14 56.79	54 51.352 +14.685	L 23 15.6479 4361
24.0	90 47 13.09	+4 43 00.50	15 00.80	55 06.037	U 24 04.0922 12.4443

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
	° ' "	° ' "	' "	' "	U ^d 24 ^h 04 ^h 09 ^h 22 ^h
Oct. 24.0	90 47 13.09	+4 43 00.50	15 00.80	55 06.037 +16.683	L 24 16.5422 12.4500
24.5	96 57 08.79	4 56 52.43	15 05.34	55 22.720 18.686	U 25 04.9949 .4527
25.0	103 10 58.72	5 07 24.30	15 10.43	55 41.406 20.649	L 25 17.4476 .4527
25.5	109 29 11.06	5 14 22.68	15 16.06	56 02.055 22.528	U 26 05.8977 .4501
26.0	115 52 13.53	5 17 35.09	15 22.20	56 24.583 24.258	L 26 18.3432 12.4396
26.5	122 20 32.65	+5 16 50.23	15 28.80	56 48.841 +25.777	U 27 06.7828 .4329
27.0	128 54 32.86	5 11 58.43	15 35.83	57 14.618 27.004	L 27 19.2157 .4264
27.5	135 34 35.46	5 02 52.15	15 43.18	57 41.622 27.857	U 28 07.6421 .4207
28.0	142 20 57.49	4 49 26.60	15 50.77	58 09.479 28.254	L 28 20.0628 .4164
28.5	149 13 50.43	4 31 40.55	15 58.47	58 37.733 28.105	U 29 08.4792 12.4139
29.0	156 13 18.98	+4 09 37.16	16 06.13	59 05.838 +27.338	L 29 20.8931 .4139
29.5	163 19 19.76	3 43 24.91	16 13.58	59 33.176 25.890	U 30 09.3070 .4163
30.0	170 31 40.22	3 13 18.36	16 20.63	59 59.066 23.724	L 30 21.7233 .4215
30.5	177 49 57.77	2 39 38.92	16 27.09	60 22.790 20.833	U 31 10.1448 .4295
31.0	185 13 39.30	2 02 55.09	16 32.77	60 43.623 17.254	L 31 22.5743 12.4401
Nov. 31.5	192 42 01.19	+1 23 42.46	16 37.47	61 00.877 +13.062	U 1 11.0144 .4534
1.0	200 14 09.94	0 42 43.04	16 41.03	61 13.939 8.377	L 1 23.4678 .4683
1.5	207 49 03.37	+0 00 44.08	16 43.31	61 22.316 +3.361	U 2 11.9361 .4844
2.0	215 25 32.53	-0 41 23.67	16 44.23	61 25.677 -1.804	...
2.5	223 02 24.12	1 22 48.17	16 43.74	61 23.873 6.916	...
3.0	230 38 23.24	-2 02 38.39	16 41.85	61 16.957 -11.781	L 3 00.4205 12.5003
3.5	238 12 16.38	2 40 06.68	16 38.64	61 05.176 16.224	U 3 12.9208 .5145
4.0	245 42 54.29	3 14 30.79	16 34.22	60 48.952 20.100	L 4 01.4353 .5255
4.5	253 09 14.51	3 45 15.40	16 28.75	60 28.852 23.310	U 4 13.9608 .5315
5.0	260 30 23.50	4 11 53.02	16 22.39	60 05.542 25.796	L 5 02.4923 .5319
5.5	267 45 38.02	-4 34 04.33	16 15.37	59 39.746 -27.541	U 5 15.0242 12.5257
6.0	274 54 25.93	4 51 37.82	16 07.86	59 12.205 28.571	L 6 03.5499 .5139
6.5	281 56 26.26	5 04 29.14	16 00.08	58 43.634 28.933	U 6 16.0638 .4972
7.0	288 51 28.83	5 12 40.05	15 52.20	58 14.701 28.699	L 7 04.5610 .4772
7.5	295 39 33.29	5 16 17.33	15 44.38	57 46.002 27.950	U 7 17.0382 .4555
8.0	302 20 48.02	-5 15 31.62	15 36.76	57 18.052 -26.774	L 8 05.4937 12.4335
8.5	308 55 28.73	5 10 36.44	15 29.47	56 51.278 25.254	U 8 17.9272 .4124
9.0	315 23 57.09	5 01 47.25	15 22.59	56 26.024 23.474	L 9 06.3396 .3929
9.5	321 46 39.37	4 49 20.82	15 16.19	56 02.550 21.505	U 9 18.7325 .3758
10.0	328 04 05.13	4 33 34.66	15 10.33	55 41.045 19.415	L 10 07.1083 .3609
10.5	334 16 46.14	-4 14 46.64	15 05.04	55 21.630 -17.261	U 10 19.4692 12.3487
11.0	340 25 15.35	3 53 14.82	15 00.34	55 04.369 15.089	L 11 07.8179 .3391
11.5	346 30 06.08	3 29 17.27	14 56.23	54 49.280 12.940	U 11 20.1570 .3321
12.0	352 31 51.33	3 03 12.08	14 52.70	54 36.340 10.843	L 12 08.4891 .3276
12.5	358 31 03.25	2 35 17.31	14 49.75	54 25.497 8.823	U 12 20.8167 .3254
13.0	4 28 12.67	-2 05 51.11	14 47.35	54 16.674 -6.897	L 13 09.1421 12.3257
13.5	10 23 48.80	1 35 11.74	14 45.47	54 09.777 5.075	U 13 21.4678 .3281
14.0	16 18 19.02	1 03 37.61	14 44.09	54 04.702 3.363	L 14 09.7959 .3327
14.5	22 12 08.78	-0 31 27.38	14 43.17	54 01.339 1.761	U 14 22.1286 .3393
15.0	28 05 41.46	+0 01 00.09	14 42.69	53 59.578 -0.262	L 15 10.4679 .3478
15.5	33 59 18.48	+0 33 25.69	14 42.62	53 59.316 +1.140	U 15 22.8157 12.3579
16.0	39 53 19.32	+1 05 30.17	14 42.93	54 00.456	L 16 11.1736

MOON, 1967
FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Nov. 16.0	39 53 19.32	+1 05 30.17	14 42.93	54 00.456	L 16 11.1736 ^{d h}
16.5	45 48 01.67	1 36 54.19	14 43.60	54 02.916 + 2.460	U 16 23.5431 ^h 12.3695
17.0	51 43 41.61	2 07 18.45	14 44.61	54 06.626 3.710	L 17 11.9252 3.821
17.5	57 40 33.86	2 36 23.80	14 45.95	54 11.535 4.909	... 3.952
18.0	63 38 52.03	3 03 51.44	14 47.60	54 17.609 6.074	U 18 00.3204 ...
18.5	69 38 48.93	+3 29 23.04	14 49.57	54 24.834 7.225	L 18 12.7287 ...
19.0	75 40 36.86	3 52 40.96	14 51.85	54 33.211 + 8.377	U 19 01.1494 12.4207
19.5	81 44 27.97	4 13 28.38	14 54.45	54 42.760 9.549	L 19 13.5811 4.317
20.0	87 50 34.53	4 31 29.49	14 57.38	54 53.511 10.751	U 20 02.0217 4.406
20.5	93 59 09.23	4 46 29.65	15 00.65	55 05.505 11.994	L 20 14.4684 4.467
21.0	100 10 25.44	+4 58 15.46	15 04.27	55 18.785 13.280	U 21 02.9182 4.498
21.5	106 24 37.38	5 06 34.98	15 08.25	55 33.392 +14.607	L 21 15.3680 12.4498
22.0	112 42 00.20	5 11 17.76	15 12.60	55 49.357 15.965	U 22 03.8148 4.468
22.5	119 02 50.00	5 12 15.07	15 17.32	56 06.695 17.338	L 22 16.2563 4.415
23.0	125 27 23.71	5 09 20.00	15 22.42	56 25.395 18.700	U 23 04.6907 4.344
23.5	131 55 58.84	+5 02 27.66	15 27.87	56 45.412 20.017	L 23 17.1170 4.263
24.0	138 28 53.14	4 51 35.47	15 33.66	57 06.656 +21.244	U 24 05.5352 12.4182
24.5	145 06 23.97	4 36 43.43	15 39.74	57 28.987 22.331	L 24 17.9457 4.105
25.0	151 48 47.69	4 17 54.53	15 46.07	57 52.202 23.215	U 25 06.3499 4.042
25.5	158 36 18.70	3 55 15.16	15 52.56	58 16.030 23.828	L 25 18.7495 3.996
26.0	165 29 08.43	+3 28 55.60	15 59.12	58 40.127 24.097	U 26 07.1466 3.971
26.5	172 27 24.21	2 59 10.55	16 05.65	59 04.074 +23.947	L 26 19.5439 12.3973
27.0	179 31 07.97	2 26 19.56	16 12.00	59 27.382 23.308	U 27 07.9441 4.002
27.5	186 40 15.01	1 50 47.42	16 18.02	59 49.500 22.118	L 27 20.3502 4.061
28.0	193 54 32.77	1 13 04.34	16 23.56	60 09.834 20.334	U 28 08.7652 4.150
28.5	201 13 39.84	+0 33 45.82	16 28.45	60 27.766 17.932	L 28 21.1923 4.271
29.0	208 37 05.23	-0 06 27.80	16 32.52	60 42.690 +14.924	U 29 09.6342 12.4419
29.5	216 04 08.15	0 46 52.25	16 35.61	60 54.042 11.352	L 29 22.0933 4.591
30.0	223 33 58.32	1 26 40.67	16 37.60	61 01.342 7.300	U 30 10.5713 4.780
30.5	231 05 37.02	2 05 05.35	16 38.38	61 04.228 + 2.886	L 30 23.0684 4.971
Dec. 1.0	238 37 58.72	-2 41 19.69	16 37.91	61 02.487 - 1.741	U 1 11.5836 5.152
1.5	246 09 53.41	3 14 40.27	16 36.16	60 56.072 - 6.415	L 1 00.1138 12.5302
2.0	253 40 09.36	3 44 28.79	16 33.18	60 45.114 10.958	... 5.403
2.5	261 07 36.15	4 10 13.65	16 29.03	60 29.910 15.204	U 2 12.6541 5.440
3.0	268 31 07.68	4 31 31.04	16 23.86	60 10.905 19.005	L 3 01.1981 5.404
3.5	275 49 44.88	-4 48 05.41	16 17.80	59 48.663 22.242	U 3 13.7385 5.404
4.0	283 02 37.92	4 59 49.34	16 11.03	59 23.827 -24.836	L 4 02.2682 12.5297
4.5	290 09 07.75	5 06 42.96	16 03.74	58 57.084 26.743	U 4 14.7814 5.132
5.0	297 08 46.92	5 08 52.90	15 56.13	58 29.129 27.955	L 5 03.2737 4.923
5.5	304 01 19.68	5 06 31.06	15 48.36	58 00.629 28.500	U 5 15.7428 4.691
6.0	310 46 41.49	-4 59 53.40	15 40.62	57 32.208 28.421	L 6 04.1880 4.452
6.5	317 24 58.05	4 49 18.63	15 33.05	57 04.422 -27.786	U 6 16.6101 12.4221
7.0	323 56 24.11	4 35 07.19	15 25.78	56 37.754 26.668	L 7 05.0110 4.009
7.5	330 21 21.99	4 17 40.35	15 18.93	56 12.608 25.146	U 7 17.3928 3.818
8.0	336 40 20.12	3 57 19.57	15 12.59	55 49.312 23.296	L 8 05.7585 3.657
8.5	342 53 51.63	-3 34 26.03	15 06.81	55 28.118 21.194	U 8 18.1107 3.522
9.0	349 02 33.04	-3 09 20.38	15 01.66	55 09.210 -18.908	L 9 06.4525 12.3418

MOON, 1967
FOR 0^h AND 12^h EPHEMERIS TIME

67

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Dec. 9.0	349° 02' 33.04	-3° 09' 20.38	15' 01.66	55' 09.210 -16.502	L 9 06.4525 ^d 12.3341 ^h
9.5	355 07 03.08	2 42 22.57	14 57.16	54 52.708 14.029	U 9 18.7866 3291
10.0	1 08 01.67	2 13 51.89	14 53.34	54 38.679 11.538	L 10 07.1157 3268
10.5	7 06 09.02	1 44 07.00	14 50.20	54 27.141 9.071	U 10 19.4425 3269
11.0	13 02 04.87	1 13 26.08	14 47.73	54 18.070 6.663	L 11 07.7694 3295
11.5	18 56 27.90	-0 42 06.95	14 45.91	54 11.407 -4.343	U 11 20.0989 12.3345
12.0	24 49 55.17	-0 10 27.30	14 44.73	54 07.064 2.136	L 12 08.4334 3415
12.5	30 43 01.69	+0 21 15.25	14 44.15	54 04.928 -0.062	U 12 20.7749 3507
13.0	36 36 20.04	0 52 42.94	14 44.13	54 04.866 +1.868	L 13 09.1256 3616
13.5	42 30 20.09	1 23 37.85	14 44.64	54 06.734 3.638	U 13 21.4872 3740
14.0	48 25 28.75	+1 53 41.83	14 45.63	54 10.372 +5.247	L 14 09.8612 12.3875
14.5	54 22 09.82	2 22 36.50	14 47.06	54 15.619 6.692	U 14 22.2487 4015
15.0	60 20 43.81	2 50 03.39	14 48.88	54 22.311 7.975	L 15 10.6502 4154
15.5	66 21 28.02	3 15 44.00	14 51.06	54 30.286 9.102	U 15 23.0656 4283
16.0	72 24 36.45	3 39 20.03	14 53.54	54 39.388 10.087	L 16 11.4939 4395
16.5	78 30 20.03	+4 00 33.63	14 56.28	54 49.475 +10.941	U 16 23.9334 12.4480
17.0	84 38 46.81	4 19 07.65	14 59.26	55 00.416 11.683	... ..
17.5	90 50 02.22	4 34 45.99	15 02.45	55 12.099 12.331	L 17 12.3814 4535
18.0	97 04 09.55	4 47 13.92	15 05.81	55 24.430 12.904	U 18 00.8349 4554
18.5	103 21 10.33	4 56 18.40	15 09.32	55 37.334 13.423	L 18 13.2903 4538
19.0	109 41 04.93	+5 01 48.41	15 12.98	55 50.757 +13.904	U 19 01.7441 12.4490
19.5	116 03 53.09	5 03 35.20	15 16.77	56 04.661 14.362	L 19 14.1931 4417
20.0	122 29 34.47	5 01 32.58	15 20.68	56 19.023 14.806	U 20 02.6348 4325
20.5	128 58 09.17	4 55 37.08	15 24.71	56 33.829 15.242	L 20 15.0673 4227
21.0	135 29 38.19	4 45 48.14	15 28.87	56 49.071 15.665	U 21 03.4900 4128
21.5	142 04 03.73	+4 32 08.21	15 33.13	57 04.736 +16.067	L 21 15.9028 12.4036
22.0	148 41 29.43	4 14 42.87	15 37.51	57 20.803 16.426	U 22 04.3064 3960
22.5	155 22 00.37	3 53 40.87	15 41.99	57 37.229 16.717	L 22 16.7024 3903
23.0	162 05 42.86	3 29 14.24	15 46.54	57 53.946 16.905	U 23 05.0927 3868
23.5	168 52 44.13	3 01 38.35	15 51.15	58 10.851 16.946	L 23 17.4795 3861
24.0	175 43 11.68	+2 31 11.91	15 55.76	58 27.797 +16.792	U 24 05.8656 12.3882
24.5	182 37 12.49	1 58 17.12	16 00.34	58 44.589 16.393	L 24 18.2538 3932
25.0	189 34 52.07	1 23 19.59	16 04.81	59 00.982 15.698	U 25 06.6470 4016
25.5	196 36 13.29	0 46 48.35	16 09.08	59 16.680 14.662	L 25 19.0486 4128
26.0	203 41 15.17	+0 09 15.68	16 13.08	59 31.342 13.246	U 26 07.4614 4271
26.5	210 49 51.63	-0 28 43.20	16 16.69	59 44.588 +11.427	L 26 19.8885 12.4440
27.0	218 01 50.33	1 06 30.62	16 19.80	59 56.015 9.199	U 27 08.3325 4628
27.5	225 16 51.71	1 43 27.22	16 22.31	60 05.214 6.578	L 27 20.7953 4825
28.0	232 34 28.33	2 18 52.88	16 24.10	60 11.792 3.605	U 28 09.2778 5018
28.5	239 54 04.70	2 52 07.97	16 25.08	60 15.397 +0.349	L 28 21.7796 5188
29.0	247 14 57.62	-3 22 34.71	16 25.17	60 15.746 -3.104	U 29 10.2984 12.5317
29.5	254 36 17.14	3 49 38.61	16 24.33	60 12.642 6.643	L 29 22.8301 5388
30.0	261 57 08.10	4 12 49.86	16 22.52	60 05.999 10.152	U 30 11.3689 5389
30.5	269 16 32.20	4 31 44.54	16 19.75	59 55.847 13.505	L 30 23.9078 5317
31.0	276 33 30.46	4 46 05.54	16 16.07	59 42.342 16.588	... ..
31.5	283 47 05.79	-4 55 42.94	16 11.55	59 25.754 -19.296	U 31 12.4395 12.5182
32.0	290 56 25.56	-5 00 34.15	16 06.30	59 06.458	L 32 00.9577

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination					
January 1									January 3										
h	m	s	°	'	°	'	"		h	m	s	°	'	°	'	"			
0	10	36	53.527		+13	52	12.60	-863.06	0	12	20	15.881		+	1	24	32.88	-973.40	
1	10	39	07.725	134.198	13	37	49.54	867.55	1	12	22	21.736	125.855		1	08	19.48	973.52	
2	10	41	21.647	133.922	13	23	21.99	871.95	2	12	24	27.537	125.801		0	52	05.96	973.55	
3	10	43	35.298	133.651	13	08	50.04	876.24	3	12	26	33.291	125.754		0	35	52.41	973.51	
4	10	45	48.681	133.383	12	54	13.80	880.44	4	12	28	39.003	125.712		0	19	38.90	973.37	
5	10	48	01.799	133.118	12	39	33.36	884.54	5	12	30	44.678	125.675	+	0	03	25.53	973.31	
6	10	50	14.656	132.857	12	24	48.82	888.55	6	12	32	50.320	125.642	-	0	12	47.62	973.15	
7	10	52	27.256	132.600	12	10	00.27	892.46	7	12	34	55.937	125.617		0	29	00.47	972.85	
8	10	54	39.602	132.346	11	55	07.81	896.28	8	12	37	01.531	125.594		0	45	12.94	972.47	
9	10	56	51.699	132.097	11	40	11.53	899.99	9	12	39	07.110	125.579		1	01	24.93	971.99	
10	10	59	03.549	131.850	11	25	11.54	903.62	10	12	41	12.678	125.568		1	17	36.37	971.44	
11	11	01	15.158	131.609	11	10	07.92	907.15	11	12	43	18.240	125.562		1	33	47.18	970.81	
12	11	03	26.529	131.371	10	55	00.77	910.58	12	12	45	23.802	125.562		1	49	57.26	970.08	
13	11	05	37.666	131.137	10	39	50.19	913.92	13	12	47	29.368	125.566		2	06	06.54	969.28	
14	11	07	48.574	130.908	10	24	36.27	917.16	14	12	49	34.945	125.577		2	22	14.94	968.40	
15	11	09	59.256	130.682	10	09	19.11	920.32	15	12	51	40.536	125.591		2	38	22.36	967.42	
16	11	12	09.718	130.462	9	53	58.79	923.37	16	12	53	46.149	125.613		2	54	28.73	966.37	
17	11	14	19.962	130.244	9	38	35.42	926.33	17	12	55	51.786	125.637		3	10	33.97	965.24	
18	11	16	29.995	130.033	9	23	09.09	929.21	18	12	57	57.455	125.669		3	26	37.99	964.02	
19	11	18	39.820	129.825	9	07	39.88	931.98	19	13	00	03.159	125.704		3	42	40.70	962.71	
20	11	20	49.441	129.621	8	52	07.90	934.67	20	13	02	08.904	125.745		3	58	42.04	961.34	
21	11	22	58.864	129.423	8	36	33.23	937.26	21	13	04	14.696	125.792		4	14	41.90	959.86	
22	11	25	08.093	129.229	8	20	55.97	939.76	22	13	06	20.538	125.842		4	30	40.22	958.32	
23	11	27	17.132	129.039	+	8	05	16.21	-942.17	23	13	08	26.437	125.899	-	4	46	36.91	956.69
				128.854									125.960					-954.98	
January 2									January 4										
0	11	29	25.986	128.675	+	7	49	34.04	-944.48	0	13	10	32.397	126.026	-	5	02	31.89	-953.17
1	11	31	34.661	128.499	7	33	49.56	946.72	1	13	12	38.423	126.097		5	18	25.06	951.31	
2	11	33	43.160	128.329	7	18	02.84	948.84	2	13	14	44.520	126.174		5	34	16.37	949.34	
3	11	35	51.489	128.164	7	02	14.00	950.89	3	13	16	50.694	126.255		5	50	05.71	947.30	
4	11	37	59.653	128.002	6	46	23.11	952.85	4	13	18	56.949	126.341		6	05	53.01	945.17	
5	11	40	07.655	127.847	6	30	30.26	954.71	5	13	21	03.290	126.432		6	21	38.18	942.97	
6	11	42	15.502	127.697	6	14	35.55	956.49	6	13	23	09.722	126.528		6	37	21.15	940.68	
7	11	44	23.199	127.550	5	58	39.06	958.17	7	13	25	16.250	126.628		6	53	01.83	938.31	
8	11	46	30.749	127.410	5	42	40.89	959.76	8	13	27	22.878	126.734		7	08	40.14	935.85	
9	11	48	38.159	127.274	5	26	41.13	961.28	9	13	29	29.612	126.844		7	24	15.99	933.33	
10	11	50	45.433	127.143	5	10	39.85	962.69	10	13	31	36.456	126.958		7	39	49.32	930.70	
11	11	52	52.576	127.017	4	54	37.16	964.02	11	13	33	43.414	127.079		7	55	20.02	928.01	
12	11	54	59.593	126.898	4	38	33.14	965.27	12	13	35	50.493	127.202		8	10	48.03	925.22	
13	11	57	06.491	126.781	4	22	27.87	966.42	13	13	37	57.695	127.331		8	26	13.25	922.36	
14	11	59	13.272	126.672	4	06	21.45	967.49	14	13	40	05.026	127.464		8	41	35.61	919.42	
15	12	01	19.944	126.566	3	50	13.96	968.46	15	13	42	12.490	127.602		8	56	55.03	916.39	
16	12	03	26.510	126.467	3	34	05.50	969.36	16	13	44	20.092	127.745		9	12	11.42	913.28	
17	12	05	32.977	126.371	3	17	56.14	970.17	17	13	46	27.837	127.890		9	27	24.70	910.08	
18	12	07	39.348	126.282	3	01	45.97	970.88	18	13	48	35.727	128.042		9	42	34.78	906.82	
19	12	09	45.630	126.198	2	45	35.09	971.52	19	13	50	43.769	128.198		9	57	41.60	903.45	
20	12	11	51.828	126.119	2	29	23.57	972.07	20	13	52	51.967	128.356		10	12	45.05	900.02	
21	12	13	57.947	126.045	2	13	11.50	972.53	21	13	55	00.323	128.521		10	27	45.07	896.50	
22	12	16	03.992	125.976	1	56	58.97	972.90	22	13	57	08.844	128.688		10	42	41.57	892.89	
23	12	18	09.968	125.913	1	40	46.07	973.19	23	13	59	17.532	128.861		10	57	34.46	889.21	
24	12	20	15.881		+	1	24	32.88		24	14	01	26.393		-	11	12	23.67	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
January 5			January 7		
h	^h ^m ^s	[°] ['] ["]	h	^h ^m ^s	[°] ['] ["]
0	14 01 26.393	-11 12 23.67	0	15 48 54.829	-21 24 42.11
1	14 03 35.429	11 27 09.11	1	15 51 15.412	21 34 50.72
2	14 05 44.645	11 41 50.70	2	15 53 36.255	21 44 51.64
3	14 07 54.046	11 56 28.35	3	15 55 57.357	21 54 44.80
4	14 10 03.634	12 11 01.99	4	15 58 18.717	22 04 30.13
5	14 12 13.413	12 25 31.53	5	16 00 40.332	22 14 07.56
6	14 14 23.388	12 39 56.90	6	16 03 02.201	22 23 37.01
7	14 16 33.562	12 54 18.00	7	16 05 24.321	22 32 58.42
8	14 18 43.938	13 08 34.75	8	16 07 46.692	22 42 11.72
9	14 20 54.520	13 22 47.08	9	16 10 09.309	22 51 16.84
10	14 23 05.311	13 36 54.90	10	16 12 32.171	23 00 13.72
11	14 25 16.315	13 50 58.12	11	16 14 55.275	23 09 02.29
12	14 27 27.535	14 04 56.67	12	16 17 18.618	23 17 42.49
13	14 29 38.974	14 18 50.46	13	16 19 42.198	23 26 14.25
14	14 31 50.635	14 32 39.41	14	16 22 06.010	23 34 37.51
15	14 34 02.521	14 46 23.44	15	16 24 30.052	23 42 52.21
16	14 36 14.635	15 00 02.47	16	16 26 54.321	23 50 58.28
17	14 38 26.981	15 13 36.40	17	16 29 18.812	23 58 55.67
18	14 40 39.560	15 27 05.17	18	16 31 43.522	24 06 44.32
19	14 42 52.375	15 40 28.69	19	16 34 08.447	24 14 24.18
20	14 45 05.430	15 53 46.87	20	16 36 33.583	24 21 55.17
21	14 47 18.725	16 06 59.64	21	16 38 58.925	24 29 17.26
22	14 49 32.264	16 20 06.91	22	16 41 24.470	24 36 30.39
23	14 51 46.050	-16 33 08.60	23	16 43 50.212	-24 43 34.50
	134.033	-776.03		145.936	-415.04
January 6			January 8		
0	14 54 00.083	-16 46 04.63	0	16 46 16.148	-24 50 29.54
1	14 56 14.366	16 58 54.91	1	16 48 42.272	24 57 15.46
2	14 58 28.902	17 11 39.37	2	16 51 08.578	25 03 52.22
3	15 00 43.691	17 24 17.93	3	16 53 35.063	25 10 19.76
4	15 02 58.736	17 36 50.50	4	16 56 01.721	25 16 38.05
5	15 05 14.038	17 49 17.00	5	16 58 28.546	25 22 47.02
6	15 07 29.598	18 01 37.36	6	17 00 55.533	25 28 46.65
7	15 09 45.418	18 13 51.49	7	17 03 22.677	25 34 36.89
8	15 12 01.500	18 25 59.30	8	17 05 49.970	25 40 17.70
9	15 14 17.844	18 38 00.73	9	17 08 17.408	25 45 49.04
10	15 16 34.451	18 49 55.69	10	17 10 44.985	25 51 10.87
11	15 18 51.323	19 01 44.10	11	17 13 12.694	25 56 23.16
12	15 21 08.459	19 13 25.89	12	17 15 40.528	26 01 25.87
13	15 23 25.860	19 25 00.97	13	17 18 08.483	26 06 18.97
14	15 25 43.528	19 36 29.26	14	17 20 36.550	26 11 02.43
15	15 28 01.462	19 47 50.69	15	17 23 04.723	26 15 36.22
16	15 30 19.662	19 59 05.18	16	17 25 32.996	26 20 00.31
17	15 32 38.128	20 10 12.66	17	17 28 01.362	26 24 14.68
18	15 34 56.861	20 21 13.04	18	17 30 29.814	26 28 19.30
19	15 37 15.860	20 32 06.25	19	17 32 58.345	26 32 14.14
20	15 39 35.125	20 42 52.21	20	17 35 26.947	26 35 59.19
21	15 41 54.655	20 53 30.85	21	17 37 55.614	26 39 34.43
22	15 44 14.450	21 04 02.10	22	17 40 24.337	26 42 59.84
23	15 46 34.508	21 14 25.88	23	17 42 53.111	26 46 15.41
24	15 48 54.829	-21 24 42.11	24	17 45 21.927	-26 49 21.11
	140.321	-616.23		148.816	-185.70

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
January 9			January 11		
h m s	° ' "	° ' "	h m s	° ' "	° ' "
0 17 45 21.927	148.852	-26 49 21.11	0 19 42 45.862	141.767	-26 07 21.97
1 17 47 50.779	148.878	26 52 16.94	1 19 45 07.629	141.463	26 02 43.34
2 17 50 19.657	148.899	26 55 02.89	2 19 47 29.092	141.153	25 57 56.29
3 17 52 48.556	148.910	26 57 38.94	3 19 49 50.245	140.840	25 53 00.86
4 17 55 17.466	148.916	27 00 05.10	4 19 52 11.085	140.522	25 47 57.14
5 17 57 46.382	148.912	27 02 21.35	5 19 54 31.607	140.201	25 42 45.18
6 18 00 15.294	148.901	27 04 27.70	6 19 56 51.808	139.875	25 37 25.05
7 18 02 44.195	148.882	27 06 24.13	7 19 59 11.683	139.545	25 31 56.82
8 18 05 13.077	148.855	27 08 10.65	8 20 01 31.228	139.213	25 26 20.55
9 18 07 41.932	148.822	27 09 47.27	9 20 03 50.441	138.875	25 20 36.31
10 18 10 10.754	148.779	27 11 13.99	10 20 06 09.316	138.536	25 14 44.18
11 18 12 39.533	148.729	27 12 30.80	11 20 08 27.852	138.192	25 08 44.21
12 18 15 08.262	148.671	27 13 37.73	12 20 10 46.044	137.846	25 02 36.49
13 18 17 36.933	148.605	27 14 34.77	13 20 13 03.890	137.497	24 56 21.07
14 18 20 05.538	148.532	27 15 21.94	14 20 15 21.387	137.146	24 49 58.04
15 18 22 34.070	148.450	27 15 59.26	15 20 17 38.533	136.790	24 43 27.46
16 18 25 02.520	148.361	27 16 26.73	16 20 19 55.323	136.434	24 36 49.40
17 18 27 30.881	148.264	27 16 44.37	17 20 22 11.757	136.074	24 30 03.94
18 18 29 59.145	148.160	27 16 52.21	18 20 24 27.831	135.713	24 23 11.15
19 18 32 27.305	148.047	27 16 50.25	19 20 26 43.544	135.350	24 16 11.10
20 18 34 55.352	147.927	27 16 38.53	20 20 28 58.894	134.984	24 09 03.87
21 18 37 23.279	147.799	27 16 17.06	21 20 31 13.878	134.617	24 01 49.53
22 18 39 51.078	147.664	27 15 45.88	22 20 33 28.495	134.249	23 54 28.15
23 18 42 18.742	147.522	-27 15 05.00	23 20 35 42.744	133.878	-23 46 59.82
		+ 50.55			+455.23
January 10			January 12		
h m s	° ' "	° ' "	h m s	° ' "	° ' "
0 18 44 46.264	147.371	-27 14 14.45	0 20 37 56.622	133.507	-23 39 24.59
1 18 47 13.635	147.213	27 13 14.27	1 20 40 10.129	133.134	23 31 42.55
2 18 49 40.848	147.049	27 12 04.48	2 20 42 23.263	132.761	23 23 53.78
3 18 52 07.897	146.876	27 10 45.12	3 20 44 36.024	132.387	23 15 58.34
4 18 54 34.773	146.697	27 09 16.23	4 20 46 48.411	132.011	23 07 56.32
5 18 57 01.470	146.511	27 07 37.83	5 20 49 00.422	131.636	22 59 47.78
6 18 59 27.981	146.318	27 05 49.97	6 20 51 12.058	131.259	22 51 32.80
7 19 01 54.299	146.117	27 03 52.69	7 20 53 23.317	130.882	22 43 11.47
8 19 04 20.416	145.911	27 01 46.03	8 20 55 34.199	130.505	22 34 43.85
9 19 06 46.327	145.696	26 59 30.03	9 20 57 44.704	130.129	22 26 10.01
10 19 09 12.023	145.477	26 57 04.73	10 20 59 54.833	129.751	22 17 30.04
11 19 11 37.500	145.250	26 54 30.18	11 21 02 04.584	129.375	22 08 44.01
12 19 14 02.750	145.016	26 51 46.42	12 21 04 13.959	128.998	21 59 52.00
13 19 16 27.766	144.777	26 48 53.51	13 21 06 22.957	128.622	21 50 54.07
14 19 18 52.543	144.532	26 45 51.48	14 21 08 31.579	128.246	21 41 50.31
15 19 21 17.075	144.280	26 42 40.40	15 21 10 39.825	127.870	21 32 40.78
16 19 23 41.355	144.023	26 39 20.32	16 21 12 47.695	127.497	21 23 25.57
17 19 26 05.378	143.760	26 35 51.28	17 21 14 55.192	127.123	21 14 04.75
18 19 28 29.138	143.490	26 32 13.34	18 21 17 02.315	126.750	21 04 38.39
19 19 30 52.628	143.217	26 28 26.55	19 21 19 09.065	126.379	20 55 06.57
20 19 33 15.845	142.937	26 24 30.98	20 21 21 15.444	126.008	20 45 29.35
21 19 35 38.782	142.651	26 20 26.68	21 21 23 21.452	125.639	20 35 46.82
22 19 38 01.433	142.362	26 16 13.70	22 21 25 27.091	125.271	20 25 59.04
23 19 40 23.795	142.067	26 11 52.11	23 21 27 32.362	124.905	20 16 06.10
24 19 42 45.862		-26 07 21.97	24 21 29 37.267		+598.05
		+70.14			

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
January 13							January 15						
^b	^h	^m	^s		[°]	[']	^b	^h	^m	^s		[°]	[']
0	21	29	37.267	124.540	-20	06 08.05	0	23	03	09.539	110.238	-10	49 49.52
1	21	31	41.807	124.177		19 56 04.98	1	23	04	59.777	110.026		10 37 01.98
2	21	33	45.984	123.816		19 45 56.96	2	23	06	49.803	109.820		10 24 12.42
3	21	35	49.800	123.456		19 35 44.05	3	23	08	39.623	109.617		10 11 20.89
4	21	37	53.256	123.098		19 25 26.33	4	23	10	29.240	109.419		9 58 27.44
5	21	39	56.354	122.742		19 15 03.87	5	23	12	18.659	109.224		9 45 32.12
6	21	41	59.096	122.389		19 04 36.75	6	23	14	07.883	109.035		9 32 34.98
7	21	44	01.485	122.037		18 54 05.02	7	23	15	56.918	108.848		9 19 36.07
8	21	46	03.522	121.688		18 43 28.76	8	23	17	45.766	108.666		9 06 35.43
9	21	48	05.210	121.341		18 32 48.04	9	23	19	34.432	108.488		8 53 33.11
10	21	50	06.551	120.996		18 22 02.94	10	23	21	22.920	108.316		8 40 29.16
11	21	52	07.547	120.655		18 11 13.51	11	23	23	11.236	108.146		8 27 23.62
12	21	54	08.202	120.314		18 00 19.82	12	23	24	59.382	107.981		8 14 16.54
13	21	56	08.516	119.978		17 49 21.95	13	23	26	47.363	107.820		8 01 07.97
14	21	58	08.494	119.644		17 38 19.95	14	23	28	35.183	107.665		7 47 57.96
15	22	00	08.138	119.312		17 27 13.91	15	23	30	22.848	107.512		7 34 46.53
16	22	02	07.450	118.983		17 16 03.88	16	23	32	10.360	107.364		7 21 33.75
17	22	04	06.433	118.657		17 04 49.92	17	23	33	57.724	107.221		7 08 19.66
18	22	06	05.090	118.334		16 53 32.11	18	23	35	44.945	107.082		6 55 04.29
19	22	08	03.424	118.015		16 42 10.51	19	23	37	32.027	106.946		6 41 47.70
20	22	10	01.439	117.697		16 30 45.19	20	23	39	18.973	106.817		6 28 29.93
21	22	11	59.136	117.384		16 19 16.20	21	23	41	05.790	106.690		6 15 11.02
22	22	13	56.520	117.072		16 07 43.61	22	23	42	52.480	106.569		6 01 51.01
23	22	15	53.592	116.766		-15 56 07.49	23	23	44	39.049	106.451		- 5 48 29.94
January 14							January 16						
0	22	17	50.358	116.461		-15 44 27.89	0	23	46	25.500	106.339		- 5 35 07.86
1	22	19	46.819	116.160		15 32 44.89	1	23	48	11.839	106.229		5 21 44.81
2	22	21	42.979	115.862		15 20 58.53	2	23	49	58.068	106.126		5 08 20.83
3	22	23	38.841	115.568		15 09 08.88	3	23	51	44.194	106.025		4 54 55.97
4	22	25	34.409	115.277		14 57 16.01	4	23	53	30.219	105.931		4 41 30.26
5	22	27	29.686	114.990		14 45 19.97	5	23	55	16.150	105.839		4 28 03.74
6	22	29	24.676	114.706		14 33 20.81	6	23	57	01.989	105.753		4 14 36.46
7	22	31	19.382	114.426		14 21 18.61	7	23	58	47.742	105.671		4 01 08.45
8	22	33	13.808	114.149		14 09 13.42	8	00	00	33.413	105.593		3 47 39.76
9	22	35	07.957	113.877		13 57 05.30	9	00	02	19.006	105.520		3 34 10.43
10	22	37	01.834	113.606		13 44 54.30	10	00	04	04.526	105.451		3 20 40.49
11	22	38	55.440	113.341		13 32 40.48	11	00	05	49.977	105.387		3 07 09.98
12	22	40	48.781	113.079		13 20 23.90	12	00	07	35.364	105.326		2 53 38.95
13	22	42	41.860	112.821		13 08 04.62	13	00	09	20.690	105.272		2 40 07.44
14	22	44	34.681	112.567		12 55 42.69	14	00	11	05.962	105.221		2 26 35.48
15	22	46	27.248	112.316		12 43 18.16	15	00	12	51.183	105.174		2 13 03.11
16	22	48	19.564	112.069		12 30 51.09	16	00	14	36.357	105.133		1 59 30.37
17	22	50	11.633	111.826		12 18 21.54	17	00	16	21.490	105.095		1 45 57.30
18	22	52	03.459	111.588		12 05 49.55	18	00	18	06.585	105.062		1 32 23.94
19	22	53	55.047	111.352		11 53 15.19	19	00	19	51.647	105.033		1 18 50.33
20	22	55	46.399	111.122		11 40 38.50	20	00	21	36.680	105.010		1 05 16.50
21	22	57	37.521	110.894		11 27 59.53	21	00	23	21.690	104.991		0 51 42.50
22	22	59	28.415	110.672		11 15 18.35	22	00	25	06.681	104.975		0 38 08.35
23	23	01	19.087	110.452		11 02 35.00	23	00	26	51.656	104.965		0 24 34.11
24	23	03	09.539			-10 49 49.52	24	00	28	36.621			- 0 10 59.80

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
January 17			January 19		
h	h m s	° ' "	h	h m s	° ' "
0	0 23 36.621	104.960	0	1 53 52.369	110.071
1	0 30 21.581	104.958	1	1 55 42.440	110.289
2	0 32 06.539	104.961	2	1 57 32.729	110.514
3	0 33 51.500	104.969	3	1 59 23.243	110.742
4	0 35 36.469	104.981	4	2 01 13.985	110.975
5	0 37 21.450	104.999	5	2 03 04.960	111.212
6	0 39 06.449	105.019	6	2 04 56.172	111.454
7	0 40 51.468	105.046	7	2 06 47.626	111.701
8	0 42 36.514	105.076	8	2 08 39.327	111.952
9	0 44 21.590	105.111	9	2 10 31.279	112.207
10	0 46 06.701	105.152	10	2 12 23.486	112.467
11	0 47 51.853	105.195	11	2 14 15.953	112.732
12	0 49 37.048	105.244	12	2 16 08.685	113.001
13	0 51 22.292	105.297	13	2 18 01.686	113.273
14	0 53 07.589	105.356	14	2 19 54.959	113.552
15	0 54 52.945	105.418	15	2 21 48.511	113.833
16	0 56 38.363	105.485	16	2 23 42.344	114.120
17	0 58 23.848	105.557	17	2 25 36.464	114.411
18	1 00 09.405	105.634	18	2 27 30.875	114.705
19	1 01 55.039	105.714	19	2 29 25.580	115.005
20	1 03 40.753	105.800	20	2 31 20.585	115.309
21	1 05 26.553	105.890	21	2 33 15.894	115.617
22	1 07 12.443	105.985	22	2 35 11.511	115.928
23	1 08 58.428	106.085	23	2 37 07.439	116.245
January 18			January 20		
0	1 10 44.513	106.188	0	2 39 03.684	116.565
1	1 12 30.701	106.297	1	2 41 00.249	116.889
2	1 14 16.998	106.410	2	2 42 57.138	117.219
3	1 16 03.408	106.528	3	2 44 54.357	117.550
4	1 17 49.936	106.651	4	2 46 51.907	117.888
5	1 19 36.587	106.778	5	2 48 49.795	118.227
6	1 21 23.365	106.909	6	2 50 48.022	118.573
7	1 23 10.274	107.046	7	2 52 46.595	118.920
8	1 24 57.320	107.187	8	2 54 45.515	119.273
9	1 26 44.507	107.332	9	2 56 44.788	119.629
10	1 28 31.839	107.483	10	2 58 44.417	119.988
11	1 30 19.322	107.638	11	3 00 44.405	120.352
12	1 32 06.960	107.797	12	3 02 44.757	120.719
13	1 33 54.757	107.961	13	3 04 45.476	121.089
14	1 35 42.718	108.130	14	3 06 46.565	121.463
15	1 37 30.848	108.303	15	3 08 48.028	121.841
16	1 39 19.151	108.481	16	3 10 49.869	122.222
17	1 41 07.632	108.664	17	3 12 52.091	122.606
18	1 42 56.296	108.851	18	3 14 54.697	122.993
19	1 44 45.147	109.042	19	3 16 57.690	123.384
20	1 46 34.189	109.239	20	3 19 01.074	123.778
21	1 48 23.428	109.440	21	3 21 04.852	124.175
22	1 50 12.868	109.646	22	3 23 09.027	124.575
23	1 52 02.514	109.855	23	3 25 13.602	124.977
24	1 53 52.369		24	3 27 18.579	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
January 21			January 23		
h	h m s	° ' "	h	h m s	° ' "
0	3 27 18.579	+19 52 18.43	0	5 15 40.878	+26 06 45.34
1	3 29 23.962	20 02 30.43	1	5 18 06.744	26 11 30.38
2	3 31 29.753	20 12 37.55	2	5 20 32.996	26 16 06.55
3	3 33 35.955	20 22 39.71	3	5 22 59.631	26 20 33.77
4	3 35 42.571	20 32 36.83	4	5 25 26.643	26 24 51.97
5	3 37 49.602	20 42 28.84	5	5 27 54.028	26 29 01.05
6	3 39 57.052	20 52 15.65	6	5 30 21.780	26 33 00.96
7	3 42 04.922	21 01 57.20	7	5 32 49.894	26 36 51.60
8	3 44 13.215	21 11 33.40	8	5 35 18.365	26 40 32.91
9	3 46 21.932	21 21 04.18	9	5 37 47.187	26 44 04.81
10	3 48 31.077	21 30 29.44	10	5 40 16.354	26 47 27.22
11	3 50 40.649	21 39 49.13	11	5 42 45.861	26 50 40.09
12	3 52 50.652	21 49 03.14	12	5 45 15.700	26 53 43.33
13	3 55 01.087	21 58 11.41	13	5 47 45.866	26 56 36.88
14	3 57 11.956	22 07 13.84	14	5 50 16.352	26 59 20.66
15	3 59 23.259	22 16 10.37	15	5 52 47.151	27 01 54.62
16	4 01 34.998	22 25 00.90	16	5 55 18.257	27 04 18.68
17	4 03 47.174	22 33 45.35	17	5 57 49.662	27 06 32.79
18	4 05 59.788	22 42 23.65	18	6 00 21.359	27 08 36.87
19	4 08 12.841	22 50 55.69	19	6 02 53.341	27 10 30.88
20	4 10 26.334	22 59 21.41	20	6 05 25.600	27 12 14.74
21	4 12 40.268	23 07 40.72	21	6 07 58.128	27 13 48.41
22	4 14 54.642	23 15 53.53	22	6 10 30.919	27 15 11.82
23	4 17 09.457	+23 23 59.76	23	6 13 03.963	+27 16 24.92
	135.257	+479.56		153.290	+62.74
January 22			January 24		
0	4 19 24.714	+23 31 59.32	0	6 15 37.253	+27 17 27.66
1	4 21 40.412	23 39 52.13	1	6 18 10.781	27 18 19.99
2	4 23 56.551	23 47 38.10	2	6 20 44.538	27 19 01.85
3	4 26 13.131	23 55 17.15	3	6 23 18.516	27 19 33.21
4	4 28 30.151	24 02 49.18	4	6 25 52.705	27 19 54.01
5	4 30 47.611	24 10 14.12	5	6 28 27.099	27 20 04.21
6	4 33 05.511	24 17 31.87	6	6 31 01.687	27 20 03.77
7	4 35 23.848	24 24 42.36	7	6 33 36.460	27 19 52.66
8	4 37 42.623	24 31 45.49	8	6 36 11.411	27 19 30.82
9	4 40 01.833	24 38 41.18	9	6 38 46.529	27 18 58.24
10	4 42 21.477	24 45 29.34	10	6 41 21.806	27 18 14.87
11	4 44 41.554	24 52 09.89	11	6 43 57.232	27 17 20.69
12	4 47 02.063	24 58 42.74	12	6 46 32.799	27 16 15.66
13	4 49 23.000	25 05 07.81	13	6 49 08.496	27 14 59.76
14	4 51 44.364	25 11 25.00	14	6 51 44.315	27 13 32.97
15	4 54 06.152	25 17 34.23	15	6 54 20.245	27 11 55.26
16	4 56 28.363	25 23 35.43	16	6 56 56.278	27 10 06.61
17	4 58 50.992	25 29 28.49	17	6 59 32.404	27 08 07.01
18	5 01 14.039	25 35 13.34	18	7 02 08.614	27 05 56.43
19	5 03 37.498	25 40 49.90	19	7 04 44.897	27 03 34.88
20	5 06 01.368	25 46 18.08	20	7 07 21.245	27 01 02.33
21	5 08 25.645	25 51 37.80	21	7 09 57.647	26 58 18.79
22	5 10 50.324	25 56 48.97	22	7 12 34.095	26 55 24.23
23	5 13 15.403	26 01 51.51	23	7 15 10.578	26 52 18.67
24	5 15 40.878	+26 06 45.34	24	7 17 47.087	+26 49 02.10
	145.475	+293.83		156.509	-196.57

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
January 25							January 27						
^h 0	^h 7	^m 17	^s 47.087	[°] 156.526	[°] +26	['] 49 02.10	^h 0	^h 9	^m 20	^s 44.694	[°] 148.156	[°] +20	['] 45 35.37
1	7	20	23.613	156.533	26	45 34.52	1	9	23	12.850	147.854	20	34 06.61
2	7	23	00.146	156.531	26	41 55.93	2	9	25	40.704	147.551	20	22 29.63
3	7	25	36.677	156.519	26	38 06.35	3	9	28	08.255	147.246	20	10 44.52
4	7	28	13.196	156.498	26	34 05.78	4	9	30	35.501	146.939	19	58 51.39
5	7	30	49.694	156.468	26	29 54.23	5	9	33	02.440	146.630	19	46 50.33
6	7	33	26.162	156.429	26	25 31.71	6	9	35	29.070	146.320	19	34 41.44
7	7	36	02.591	156.380	26	20 58.26	7	9	37	55.390	146.008	19	22 24.84
8	7	38	38.971	156.322	26	16 13.87	8	9	40	21.398	145.697	19	10 00.62
9	7	41	15.293	156.256	26	11 18.57	9	9	42	47.095	145.384	18	57 28.90
10	7	43	51.549	156.180	26	06 12.40	10	9	45	12.479	145.070	18	44 49.76
11	7	46	27.729	156.096	26	00 55.36	11	9	47	37.549	144.757	18	32 03.33
12	7	49	03.825	156.003	25	55 27.50	12	9	50	02.306	144.442	18	19 09.70
13	7	51	39.828	155.902	25	49 48.84	13	9	52	26.748	144.127	18	06 08.99
14	7	54	15.730	155.791	25	43 59.41	14	9	54	50.875	143.813	17	53 01.31
15	7	56	51.521	155.674	25	37 59.25	15	9	57	14.688	143.499	17	39 46.76
16	7	59	27.195	155.547	25	31 48.41	16	9	59	38.187	143.185	17	26 25.44
17	8	02	02.742	155.413	25	25 26.91	17	10	02	01.372	142.872	17	12 57.48
18	8	04	38.155	155.271	25	18 54.80	18	10	04	24.244	142.559	16	59 22.99
19	8	07	13.426	155.120	25	12 12.13	19	10	06	46.803	142.247	16	45 42.06
20	8	09	48.546	154.963	25	05 18.95	20	10	09	09.050	141.936	16	31 54.82
21	8	12	23.509	154.798	24	58 15.29	21	10	11	30.986	141.626	16	18 01.38
22	8	14	58.307	154.625	24	51 01.22	22	10	13	52.612	141.318	16	04 01.84
23	8	17	32.932	154.446	+24	43 36.79	23	10	16	13.930	141.011	+15	49 56.32
						-454.74							-851.38
January 26							January 28						
0	8	20	07.378	154.259	+24	36 02.05	0	10	18	34.941	140.705	+15	35 44.94
1	8	22	41.637	154.065	24	28 17.06	1	10	20	55.646	140.401	15	21 27.80
2	8	25	15.702	153.866	24	20 21.88	2	10	23	16.047	140.099	15	07 05.02
3	8	27	49.568	153.658	24	12 16.58	3	10	25	36.146	139.799	14	52 36.71
4	8	30	23.226	153.447	24	04 01.21	4	10	27	55.945	139.501	14	38 02.98
5	8	32	56.673	153.227	23	55 35.84	5	10	30	15.446	139.205	14	23 23.95
6	8	35	29.900	153.002	23	47 00.55	6	10	32	34.651	138.911	14	08 39.74
7	8	38	02.902	152.771	23	38 15.40	7	10	34	53.562	138.620	13	53 50.45
8	8	40	35.673	152.536	23	29 20.46	8	10	37	12.182	138.331	13	38 56.19
9	8	43	08.209	152.294	23	20 15.80	9	10	39	30.513	138.045	13	23 57.09
10	8	45	40.503	152.047	23	11 01.51	10	10	41	48.558	137.762	13	08 53.26
11	8	48	12.550	151.795	23	01 37.65	11	10	44	06.320	137.482	12	53 44.80
12	8	50	44.345	151.538	22	52 04.31	12	10	46	23.802	137.204	12	38 31.84
13	8	53	15.883	151.278	22	42 21.57	13	10	48	41.006	136.929	12	23 14.48
14	8	55	47.161	151.012	22	32 29.51	14	10	50	57.935	136.659	12	07 52.84
15	8	58	18.173	150.741	22	22 28.21	15	10	53	14.594	136.390	11	52 27.03
16	9	00	48.914	150.469	22	12 17.76	16	10	55	30.984	136.125	11	36 57.17
17	9	03	19.383	150.190	22	01 58.24	17	10	57	47.109	135.864	11	21 23.37
18	9	05	49.573	149.909	21	51 29.75	18	11	00	02.973	135.607	11	05 45.74
19	9	08	19.482	149.624	21	40 52.37	19	11	02	18.580	135.352	10	50 04.40
20	9	10	49.106	149.337	21	30 06.19	20	11	04	33.932	135.101	10	34 19.44
21	9	13	18.443	149.045	21	19 11.31	21	11	06	49.033	134.855	10	18 31.00
22	9	15	47.488	148.751	21	08 07.81	22	11	09	03.888	134.612	10	02 39.18
23	9	18	16.239	148.455	20	56 55.80	23	11	11	18.500	134.373	9	46 44.09
24	9	20	44.694		+20	45 35.37	24	11	13	32.873		+9	30 45.84
						-680.43							-958.25

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
January 29			January 31		
h	h m s	° ' " "	h	h m s	° ' " "
0	11 13 32.873	+ 9 30 45.84	0	12 57 49.979	- 3 42 56.94
1	11 15 47.010	9 14 44.55	1	12 59 58.305	3 59 21.78
2	11 18 00.917	8 58 40.32	2	13 02 06.633	4 15 44.73
3	11 20 14.596	8 42 33.26	3	13 04 14.965	4 32 05.71
4	11 22 28.053	8 26 23.49	4	13 06 23.308	4 48 24.63
5	11 24 41.291	8 10 11.12	5	13 08 31.666	5 04 41.39
6	11 26 54.315	7 53 56.25	6	13 10 40.044	5 20 55.92
7	11 29 07.128	7 37 38.99	7	13 12 48.447	5 37 08.12
8	11 31 19.736	7 21 19.45	8	13 14 56.880	5 53 17.90
9	11 33 32.143	7 04 57.75	9	13 17 05.347	6 09 25.18
10	11 35 44.353	6 48 33.97	10	13 19 13.853	6 25 29.87
11	11 37 56.371	6 32 08.25	11	13 21 22.404	6 41 31.88
12	11 40 08.201	6 15 40.68	12	13 23 31.003	6 57 31.13
13	11 42 19.848	5 59 11.36	13	13 25 39.655	7 13 27.53
14	11 44 31.317	5 42 40.41	14	13 27 48.365	7 29 21.00
15	11 46 42.612	5 26 07.93	15	13 29 57.138	7 45 11.45
16	11 48 53.738	5 09 34.02	16	13 32 05.978	8 00 58.79
17	11 51 04.699	4 52 58.80	17	13 34 14.890	8 16 42.95
18	11 53 15.502	4 36 22.36	18	13 36 23.877	8 32 23.84
19	11 55 26.149	4 19 44.81	19	13 38 32.946	8 48 01.37
20	11 57 36.647	4 03 06.25	20	13 40 42.100	9 03 35.46
21	11 59 47.000	3 46 26.78	21	13 42 51.342	9 19 06.03
22	12 01 57.213	3 29 46.52	22	13 45 00.679	9 34 32.99
23	12 04 07.291	+ 3 13 05.55	23	13 47 10.114	- 9 49 56.27
	129.947	-1001.56		129.537	-919.51
January 30			February 1		
0	12 06 17.238	+ 2 56 23.99	0	13 49 19.651	-10 05 15.78
1	12 08 27.061	2 39 41.92	1	13 51 29.294	10 20 31.44
2	12 10 36.763	2 22 59.46	2	13 53 39.048	10 35 43.17
3	12 12 46.350	2 06 16.71	3	13 55 48.917	10 50 50.88
4	12 14 55.827	1 49 33.76	4	13 57 58.904	11 05 54.50
5	12 17 05.199	1 32 50.71	5	14 00 09.014	11 20 53.94
6	12 19 14.470	1 16 07.66	6	14 02 19.250	11 35 49.13
7	12 21 23.646	0 59 24.71	7	14 04 29.617	11 50 39.98
8	12 23 32.732	0 42 41.96	8	14 06 40.118	12 05 26.42
9	12 25 41.733	0 25 59.51	9	14 08 50.757	12 20 08.37
10	12 27 50.654	+ 0 09 17.45	10	14 11 01.538	12 34 45.74
11	12 29 59.500	- 0 07 24.12	11	14 13 12.464	12 49 18.46
12	12 32 08.276	0 24 05.11	12	14 15 23.538	13 03 46.45
13	12 34 16.988	0 40 45.42	13	14 17 34.765	13 18 09.63
14	12 36 25.639	0 57 24.95	14	14 19 46.148	13 32 27.93
15	12 38 34.236	1 14 03.61	15	14 21 57.689	13 46 41.26
16	12 40 42.783	1 30 41.30	16	14 24 09.393	14 00 49.55
17	12 42 51.286	1 47 17.93	17	14 26 21.263	14 14 52.72
18	12 44 59.749	2 03 53.42	18	14 28 33.301	14 28 50.70
19	12 47 08.178	2 20 27.65	19	14 30 45.510	14 42 43.40
20	12 49 16.577	2 37 00.55	20	14 32 57.895	14 56 30.76
21	12 51 24.951	2 53 32.02	21	14 35 10.456	15 10 12.70
22	12 53 33.307	3 10 01.97	22	14 37 23.198	15 23 49.14
23	12 55 41.647	3 26 30.31	23	14 39 36.123	15 37 20.00
24	12 57 49.979	- 3 42 56.94	24	14 41 49.234	-15 50 45.22
	128.332	-986.63		133.111	-805.22

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
February 2			February 4		
h	h m s	° ' "	h	h m s	° ' "
0	14 41 49.234 133.298	-15 50 45.22 -799.49	0	16 32 22.431 143.190	-24 21 24.50 -445.54
1	14 44 02.532 133.490	16 04 04.71 793.70	1	16 34 45.621 143.363	24 28 50.04 436.77
2	14 46 16.022 133.682	16 17 18.41 787.82	2	16 37 08.984 143.533	24 36 06.81 427.93
3	14 48 29.704 133.877	16 30 26.23 781.89	3	16 39 32.517 143.698	24 43 14.74 419.07
4	14 50 43.581 134.075	16 43 28.12 775.86	4	16 41 56.215 143.861	24 50 13.81 410.14
5	14 52 57.656 134.275	16 56 23.98 769.78	5	16 44 20.076 144.019	24 57 03.95 401.20
6	14 55 11.931 134.475	17 09 13.76 763.61	6	16 46 44.095 144.172	25 03 45.15 392.20
7	14 57 26.406 134.679	17 21 57.37 757.37	7	16 49 08.267 144.323	25 10 17.35 383.16
8	14 59 41.085 134.885	17 34 34.74 751.07	8	16 51 32.590 144.468	25 16 40.51 374.10
9	15 01 55.970 135.090	17 47 05.81 744.69	9	16 53 57.058 144.609	25 22 54.61 364.99
10	15 04 11.060 135.300	17 59 30.50 738.25	10	16 56 21.667 144.746	25 28 59.60 355.84
11	15 06 26.360 135.509	18 11 48.75 731.72	11	16 58 46.413 144.878	25 34 55.44 346.67
12	15 08 41.869 135.720	18 24 00.47 725.13	12	17 01 11.291 145.004	25 40 42.11 337.45
13	15 10 57.589 135.932	18 36 05.60 718.47	13	17 03 36.295 145.127	25 46 19.56 328.21
14	15 13 13.521 136.146	18 48 04.07 711.75	14	17 06 01.422 145.244	25 51 47.77 318.94
15	15 15 29.667 136.360	18 59 55.82 704.94	15	17 08 26.666 145.356	25 57 06.71 309.64
16	15 17 46.027 136.576	19 11 40.76 698.08	16	17 10 52.022 145.462	26 02 16.35 300.31
17	15 20 02.603 136.792	19 23 18.84 691.14	17	17 13 17.484 145.564	26 07 16.66 290.95
18	15 22 19.395 137.009	19 34 49.98 684.14	18	17 15 43.048 145.660	26 12 07.61 281.57
19	15 24 36.404 137.226	19 46 14.12 677.08	19	17 18 08.708 145.750	26 16 49.18 272.17
20	15 26 53.630 137.444	19 57 31.20 669.93	20	17 20 34.458 145.835	26 21 21.35 262.73
21	15 29 11.074 137.662	20 08 41.13 662.73	21	17 23 00.293 145.914	26 25 44.08 253.29
22	15 31 28.736 137.880	20 19 43.86 655.47	22	17 25 26.207 145.987	26 29 57.37 243.82
23	15 33 46.616 138.099	-20 30 39.33 -648.13	23	17 27 52.194 146.055	-26 34 01.19 -234.32
February 3			February 5		
0	15 36 04.715 138.317	-20 41 27.46 -640.74	0	17 30 18.249 146.116	-26 37 55.51 -224.82
1	15 38 23.032 138.535	20 52 08.20 633.27	1	17 32 44.365 146.171	26 41 40.33 215.30
2	15 40 41.567 138.753	21 02 41.47 625.75	2	17 35 10.536 146.220	26 45 15.63 205.77
3	15 43 00.320 138.970	21 13 07.22 618.17	3	17 37 36.756 146.264	26 48 41.40 196.21
4	15 45 19.290 139.186	21 23 25.39 610.51	4	17 40 03.020 146.300	26 51 57.61 186.66
5	15 47 38.476 139.403	21 33 35.90 602.80	5	17 42 29.320 146.330	26 55 04.27 177.08
6	15 49 57.879 139.618	21 43 38.70 595.03	6	17 44 55.650 146.355	26 58 01.35 167.51
7	15 52 17.497 139.832	21 53 33.73 587.20	7	17 47 22.005 146.372	27 00 48.86 157.91
8	15 54 37.329 140.045	22 03 20.93 579.30	8	17 49 48.377 146.383	27 03 26.77 148.33
9	15 56 57.374 140.256	22 13 00.23 571.36	9	17 52 14.760 146.387	27 05 55.10 138.73
10	15 59 17.630 140.467	22 22 31.59 563.34	10	17 54 41.147 146.386	27 08 13.83 129.13
11	16 01 38.097 140.676	22 31 54.93 555.28	11	17 57 07.533 146.377	27 10 22.96 119.53
12	16 03 58.773 140.883	22 41 10.21 547.15	12	17 59 33.910 146.361	27 12 22.49 109.93
13	16 06 19.656 141.089	22 50 17.36 538.98	13	18 02 00.271 146.340	27 14 12.42 100.33
14	16 08 40.745 141.292	22 59 16.34 530.74	14	18 04 26.611 146.311	27 15 52.75 90.74
15	16 11 02.037 141.493	23 08 07.08 522.45	15	18 06 52.922 146.276	27 17 23.49 81.14
16	16 13 23.530 141.692	23 16 49.53 514.11	16	18 09 19.198 146.233	27 18 44.63 71.56
17	16 15 45.222 141.889	23 25 23.64 505.71	17	18 11 45.431 146.185	27 19 56.19 61.99
18	16 18 07.111 142.084	23 33 49.35 497.27	18	18 14 11.616 146.129	27 20 58.18 52.41
19	16 20 29.195 142.275	23 42 06.62 488.77	19	18 16 37.745 146.067	27 21 50.59 42.86
20	16 22 51.470 142.464	23 50 15.39 480.22	20	18 19 03.812 145.997	27 22 33.45 33.31
21	16 25 13.934 142.651	23 58 15.61 471.62	21	18 21 29.809 145.922	27 23 06.76 23.78
22	16 27 36.585 142.833	24 06 07.23 462.98	22	18 23 55.731 145.839	27 23 30.54 14.27
23	16 29 59.418 143.013	24 13 50.21 -454.29	23	18 26 21.570 145.749	27 23 44.81 4.76
24	16 32 22.431	-24 21 24.50	24	18 28 47.319	-27 23 49.57

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
February 6			February 8		
h m s	° ' "	° ' "	h m s	° ' "	° ' "
0	18 28 47.319	145.654	0	20 21 40.329	134.458
1	18 31 12.973	145.551	1	20 23 54.787	134.128
2	18 33 38.524	145.442	2	20 26 08.915	133.797
3	18 36 03.966	145.325	3	20 28 22.712	133.463
4	18 38 29.291	145.203	4	20 30 36.175	133.128
5	18 40 54.494	145.074	5	20 32 49.303	132.792
6	18 43 19.568	144.938	6	20 35 02.095	132.454
7	18 45 44.506	144.797	7	20 37 14.549	132.114
8	18 48 09.303	144.647	8	20 39 26.663	131.774
9	18 50 33.950	144.493	9	20 41 38.437	131.431
10	18 52 58.443	144.332	10	20 43 49.868	131.090
11	18 55 22.775	144.165	11	20 46 00.958	130.746
12	18 57 46.940	143.991	12	20 48 11.704	130.401
13	19 00 10.931	143.812	13	20 50 22.105	130.057
14	19 02 34.743	143.626	14	20 52 32.162	129.711
15	19 04 58.369	143.435	15	20 54 41.873	129.366
16	19 07 21.804	143.238	16	20 56 51.239	129.019
17	19 09 45.042	143.035	17	20 59 00.258	128.674
18	19 12 08.077	142.826	18	21 01 08.932	128.327
19	19 14 30.903	142.611	19	21 03 17.259	127.981
20	19 16 53.514	142.392	20	21 05 25.240	127.634
21	19 19 15.906	142.167	21	21 07 32.874	127.289
22	19 21 38.073	141.937	22	21 09 40.163	126.944
23	19 24 00.010	141.701	23	21 11 47.107	126.598
February 7			February 9		
h m s	° ' "	° ' "	h m s	° ' "	° ' "
0	19 26 21.711	141.460	0	21 13 53.705	126.254
1	19 28 43.171	141.214	1	21 15 59.959	125.911
2	19 31 04.385	140.964	2	21 18 05.870	125.567
3	19 33 25.349	140.709	3	21 20 11.437	125.225
4	19 35 46.058	140.449	4	21 22 16.662	124.883
5	19 38 06.507	140.184	5	21 24 21.545	124.544
6	19 40 26.691	139.916	6	21 26 26.089	124.204
7	19 42 46.607	139.642	7	21 28 30.293	123.866
8	19 45 06.249	139.365	8	21 30 34.159	123.530
9	19 47 25.614	139.083	9	21 32 37.689	123.194
10	19 49 44.697	138.798	10	21 34 40.883	122.860
11	19 52 03.495	138.509	11	21 36 43.743	122.528
12	19 54 22.004	138.216	12	21 38 46.271	122.198
13	19 56 40.220	137.919	13	21 40 48.469	121.868
14	19 58 58.139	137.620	14	21 42 50.337	121.541
15	20 01 15.759	137.316	15	21 44 51.878	121.216
16	20 03 33.075	137.009	16	21 46 53.094	120.892
17	20 05 50.084	136.701	17	21 48 53.986	120.571
18	20 08 06.785	136.387	18	21 50 54.557	120.251
19	20 10 23.172	136.073	19	21 52 54.808	119.933
20	20 12 39.245	135.754	20	21 54 54.741	119.619
21	20 14 54.999	135.434	21	21 56 54.360	119.305
22	20 17 10.433	135.110	22	21 58 53.665	118.995
23	20 19 25.543	134.786	23	22 00 52.660	118.687
24	20 21 40.329		24	22 02 51.347	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
February 10							February 12						
h	m	s	°	'	"		h	m	s	°	'	"	
0	22	02	51.347	118.381	-17	05 43.55	0	23	32	43.808	107.387	-7	04 56.83
1	22	04	49.728	118.078		16 54 22.43	1	23	34	31.195	107.247		6 51 34.95
2	22	06	47.806	117.776		16 42 57.42	2	23	36	18.442	107.110		6 38 11.84
3	22	08	45.582	117.479		16 31 28.57	3	23	38	05.552	106.978		6 24 47.57
4	22	10	43.061	117.183		16 19 55.95	4	23	39	52.530	106.849		6 11 22.17
5	22	12	40.244	116.890		16 08 19.64	5	23	41	39.379	106.725		5 57 55.69
6	22	14	37.134	116.600		15 56 39.68	6	23	43	26.104	106.604		5 44 28.18
7	22	16	33.734	116.312		15 44 56.14	7	23	45	12.708	106.487		5 30 59.69
8	22	18	30.046	116.028		15 33 09.09	8	23	46	59.195	106.375		5 17 30.25
9	22	20	26.074	115.747		15 21 18.58	9	23	48	45.570	106.266		5 03 59.92
10	22	22	21.821	115.468		15 09 24.69	10	23	50	31.836	106.162		4 50 28.75
11	22	24	17.289	115.192		14 57 27.46	11	23	52	17.998	106.061		4 36 56.77
12	22	26	12.481	114.920		14 45 26.97	12	23	54	04.059	105.964		4 23 24.03
13	22	28	07.401	114.650		14 33 23.26	13	23	55	50.023	105.872		4 09 50.58
14	22	30	02.051	114.383		14 21 16.41	14	23	57	35.895	105.783		3 56 16.46
15	22	31	56.434	114.121		14 09 06.47	15	23	59	21.678	105.699		3 42 41.72
16	22	33	50.555	113.860		13 56 53.51	16	0	01	07.377	105.619		3 29 06.39
17	22	35	44.415	113.603		13 44 37.57	17	0	02	52.996	105.542		3 15 30.53
18	22	37	38.018	113.349		13 32 18.73	18	0	04	38.538	105.470		3 01 54.17
19	22	39	31.367	113.100		13 19 57.03	19	0	06	24.008	105.402		2 48 17.36
20	22	41	24.467	112.852		13 07 32.54	20	0	08	09.410	105.338		2 34 40.15
21	22	43	17.319	112.608		12 55 05.31	21	0	09	54.748	105.277		2 21 02.57
22	22	45	09.927	112.368		12 42 35.41	22	0	11	40.025	105.222		2 07 24.67
23	22	47	02.295	112.131		-12 30 02.88	23	0	13	25.247	105.170		-1 53 46.49
						+755.09							+818.41
February 11							February 13						
0	22	48	54.426	111.898	-12	17 27.79	0	0	15	10.417	105.123	-1	40 08.08
1	22	50	46.324	111.667		12 04 50.19	1	0	16	55.540	105.079		1 26 29.47
2	22	52	37.991	111.441		11 52 10.14	2	0	18	40.619	105.040		1 12 50.71
3	22	54	29.432	111.218		11 39 27.69	3	0	20	25.659	105.004		0 59 11.84
4	22	56	20.650	110.999		11 26 42.90	4	0	22	10.663	104.973		0 45 32.90
5	22	58	11.649	110.783		11 13 55.82	5	0	23	55.636	104.946		0 31 53.94
6	23	00	02.432	110.571		11 01 06.50	6	0	25	40.582	104.924		0 18 14.99
7	23	01	53.003	110.361		10 48 15.01	7	0	27	25.506	104.904		-0 04 36.09
8	23	03	43.364	110.157		10 35 21.39	8	0	29	10.410	104.891		+0 09 02.70
9	23	05	33.521	109.956		10 22 25.70	9	0	30	55.301	104.879		0 22 41.36
10	23	07	23.477	109.758		10 09 27.99	10	0	32	40.180	104.874		0 36 19.84
11	23	09	13.235	109.564		9 56 28.32	11	0	34	25.054	104.872		0 49 58.10
12	23	11	02.799	109.373		9 43 26.73	12	0	36	09.926	104.873		1 03 36.09
13	23	12	52.172	109.187		9 30 23.27	13	0	37	54.799	104.880		1 17 13.78
14	23	14	41.359	109.005		9 17 18.01	14	0	39	39.679	104.891		1 30 51.13
15	23	16	30.364	108.825		9 04 10.98	15	0	41	24.570	104.905		1 44 28.10
16	23	18	19.189	108.650		8 51 02.25	16	0	43	09.475	104.924		1 58 04.64
17	23	20	07.839	108.479		8 37 51.86	17	0	44	54.399	104.948		2 11 40.72
18	23	21	56.318	108.311		8 24 39.86	18	0	46	39.347	104.974		2 25 16.29
19	23	23	44.629	108.148		8 11 26.29	19	0	48	24.321	105.006		2 38 51.31
20	23	25	32.777	107.988		7 58 11.23	20	0	50	09.327	105.042		2 52 25.75
21	23	27	20.765	107.832		7 44 54.70	21	0	51	54.369	105.082		3 05 59.56
22	23	29	08.597	107.679		7 31 36.75	22	0	53	39.451	105.126		3 19 32.70
23	23	30	56.276	107.532		7 18 17.45	23	0	55	24.577	105.174		3 33 05.13
24	23	32	43.808			-7 04 56.83	24	0	57	09.751			+3 46 36.82

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination			
February 14							February 16							
h	h	m	s	°	'	"	h	h	m	s	°	'	"	
0	0	57	09.751	105.227	+ 3	46 36.82	+810.90	0	2	23	38.182	112.738	+14 07 42.73	+723.17
1	0	58	54.978	105.284	4	00 07.72	810.07	1	2	25	30.920	112.997	14 19 45.90	720.22
2	1	00	40.262	105.344	4	13 37.79	809.19	2	2	27	23.917	113.260	14 31 46.12	717.21
3	1	02	25.606	105.410	4	27 06.98	808.29	3	2	29	17.177	113.526	14 43 43.33	714.14
4	1	04	11.016	105.480	4	40 35.27	807.34	4	2	31	10.703	113.798	14 55 37.47	711.04
5	1	05	56.496	105.553	4	54 02.61	806.34	5	2	33	04.501	114.073	15 07 28.51	707.86
6	1	07	42.049	105.632	5	07 28.95	805.32	6	2	34	58.574	114.352	15 19 16.37	704.65
7	1	09	27.681	105.713	5	20 54.27	804.24	7	2	36	52.926	114.634	15 31 01.02	701.38
8	1	11	13.394	105.800	5	34 18.51	803.12	8	2	38	47.560	114.921	15 42 42.40	698.05
9	1	12	59.194	105.891	5	47 41.63	801.98	9	2	40	42.481	115.212	15 54 20.45	694.68
10	1	14	45.085	105.986	6	01 03.61	800.77	10	2	42	37.693	115.506	16 05 55.13	691.23
11	1	16	31.071	106.085	6	14 24.38	799.54	11	2	44	33.199	115.805	16 17 26.36	687.75
12	1	18	17.156	106.189	6	27 43.92	798.26	12	2	46	29.004	116.106	16 28 54.11	684.19
13	1	20	03.345	106.296	6	41 02.18	796.94	13	2	48	25.110	116.412	16 40 18.30	680.60
14	1	21	49.641	106.409	6	54 19.12	795.58	14	2	50	21.522	116.721	16 51 38.90	676.93
15	1	23	36.050	106.525	7	07 34.70	794.18	15	2	52	18.243	117.035	17 02 55.83	673.22
16	1	25	22.575	106.645	7	20 48.88	792.73	16	2	54	15.278	117.351	17 14 09.05	669.44
17	1	27	09.220	106.770	7	34 01.61	791.25	17	2	56	12.629	117.672	17 25 18.49	665.61
18	1	28	55.990	106.899	7	47 12.86	789.72	18	2	58	10.301	117.995	17 36 24.10	661.71
19	1	30	42.889	107.033	8	00 22.58	788.14	19	3	00	08.296	118.323	17 47 25.81	657.77
20	1	32	29.922	107.170	8	13 30.72	786.54	20	3	02	06.619	118.654	17 58 23.58	653.75
21	1	34	17.092	107.312	8	26 37.26	784.88	21	3	04	05.273	118.988	18 09 17.33	649.68
22	1	36	04.404	107.458	8	39 42.14	783.18	22	3	06	04.261	119.326	18 20 07.01	645.54
23	1	37	51.862	107.608	+ 8	52 45.32	+781.44	23	3	08	03.587	119.667	+18 30 52.55	+641.36
February 15							February 17							
0	1	39	39.470	107.763	+ 9	05 46.76	+779.65	0	3	10	03.254	120.012	+18 41 33.91	+637.09
1	1	41	27.233	107.922	9	18 46.41	777.83	1	3	12	03.266	120.359	18 52 11.00	632.78
2	1	43	15.155	108.085	9	31 44.24	775.95	2	3	14	03.625	120.709	19 02 43.78	628.40
3	1	45	03.240	108.253	9	44 40.19	774.04	3	3	16	04.334	121.064	19 13 12.18	623.95
4	1	46	51.493	108.423	9	57 34.23	772.08	4	3	18	05.398	121.421	19 23 36.13	619.45
5	1	48	39.916	108.600	10	10 26.31	770.08	5	3	20	06.819	121.780	19 33 55.58	614.87
6	1	50	28.516	108.780	10	23 16.39	768.02	6	3	22	08.599	122.144	19 44 10.45	610.23
7	1	52	17.296	108.964	10	36 04.41	765.94	7	3	24	10.743	122.510	19 54 20.68	605.54
8	1	54	06.260	109.153	10	48 50.35	763.79	8	3	26	13.253	122.878	20 04 26.22	600.76
9	1	55	55.413	109.346	11	01 34.14	761.61	9	3	28	16.131	123.250	20 14 26.98	595.93
10	1	57	44.759	109.542	11	14 15.75	759.38	10	3	30	19.381	123.624	20 24 22.91	591.03
11	1	59	34.301	109.744	11	26 55.13	757.10	11	3	32	23.005	124.001	20 34 13.94	586.06
12	2	01	24.045	109.949	11	39 32.23	754.78	12	3	34	27.006	124.380	20 44 00.00	581.02
13	2	03	13.994	110.159	11	52 07.01	752.42	13	3	36	31.386	124.762	20 53 41.02	575.92
14	2	05	04.153	110.372	12	04 39.43	749.99	14	3	38	36.148	125.147	21 03 16.94	570.74
15	2	06	54.525	110.591	12	17 09.42	747.54	15	3	40	41.295	125.532	21 12 47.68	565.51
16	2	08	45.116	110.812	12	29 36.96	745.02	16	3	42	46.827	125.922	21 22 13.19	560.18
17	2	10	35.928	111.039	12	42 01.98	742.46	17	3	44	52.749	126.313	21 31 33.37	554.81
18	2	12	26.967	111.269	12	54 24.44	739.85	18	3	46	59.062	126.706	21 40 48.18	549.35
19	2	14	18.236	111.504	13	06 44.29	737.20	19	3	49	05.768	127.100	21 49 57.53	543.83
20	2	16	09.740	111.742	13	19 01.49	734.49	20	3	51	12.868	127.498	21 59 01.36	538.23
21	2	18	01.482	111.985	13	31 15.98	731.74	21	3	53	20.366	127.896	22 07 59.59	532.57
22	2	19	53.467	112.232	13	43 27.72	728.93	22	3	55	28.262	128.297	22 16 52.16	526.82
23	2	21	45.699	112.483	13	55 36.65	+726.08	23	3	57	36.559	128.699	22 25 38.98	+521.01
24	2	23	38.182		+14	07 42.73		24	3	59	45.258		+22 34 19.99	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
February 18			February 20		
0	3 59 45.258 ^s	+22 34 19.99 [°]	0	5 50 36.409 ^s	+27 12 28.96 [°]
1	4 01 54.360 ^s	22 42 55.12 [°]	1	5 53 04.123 ^s	27 14 52.48 [°]
2	4 04 03.867 ^s	22 51 24.28 [°]	2	5 55 32.148 ^s	27 17 06.47 [°]
3	4 06 13.781 ^s	22 59 47.41 [°]	3	5 58 00.479 ^s	27 19 10.87 [°]
4	4 08 24.101 ^s	23 08 04.44 [°]	4	6 00 29.110 ^s	27 21 05.62 [°]
5	4 10 34.830 ^s	23 16 15.28 [°]	5	6 02 58.034 ^s	27 22 50.67 [°]
6	4 12 45.969 ^s	23 24 19.86 [°]	6	6 05 27.247 ^s	27 24 25.94 [°]
7	4 14 57.518 ^s	23 32 18.11 [°]	7	6 07 56.740 ^s	27 25 51.39 [°]
8	4 17 09.477 ^s	23 40 09.96 [°]	8	6 10 26.509 ^s	27 27 06.95 [°]
9	4 19 21.849 ^s	23 47 55.31 [°]	9	6 12 56.546 ^s	27 28 12.57 [°]
10	4 21 34.632 ^s	23 55 34.11 [°]	10	6 15 26.844 ^s	27 29 08.20 [°]
11	4 23 47.828 ^s	24 03 06.28 [°]	11	6 17 57.398 ^s	27 29 53.78 [°]
12	4 26 01.436 ^s	24 10 31.73 [°]	12	6 20 28.200 ^s	27 30 29.26 [°]
13	4 28 15.457 ^s	24 17 50.39 [°]	13	6 22 59.243 ^s	27 30 54.59 [°]
14	4 30 29.891 ^s	24 25 02.18 [°]	14	6 25 30.519 ^s	27 31 09.72 [°]
15	4 32 44.738 ^s	24 32 07.03 [°]	15	6 28 02.023 ^s	27 31 14.60 [°]
16	4 34 59.996 ^s	24 39 04.87 [°]	16	6 30 33.745 ^s	27 31 09.20 [°]
17	4 37 15.667 ^s	24 45 55.60 [°]	17	6 33 05.680 ^s	27 30 53.46 [°]
18	4 39 31.749 ^s	24 52 39.15 [°]	18	6 35 37.818 ^s	27 30 27.35 [°]
19	4 41 48.241 ^s	24 59 15.46 [°]	19	6 38 10.154 ^s	27 29 50.81 [°]
20	4 44 05.143 ^s	25 05 44.43 [°]	20	6 40 42.678 ^s	27 29 03.82 [°]
21	4 46 22.454 ^s	25 12 05.99 [°]	21	6 43 15.383 ^s	27 28 06.34 [°]
22	4 48 40.172 ^s	25 18 20.07 [°]	22	6 45 48.262 ^s	27 26 58.32 [°]
23	4 50 58.296 ^s	+25 24 26.59 [°]	23	6 48 21.306 ^s	+27 25 39.74 [°]
	138.529	+358.87		153.201	-89.17
February 19			February 21		
0	4 53 16.825 ^s	+25 30 25.46 [°]	0	6 50 54.507 ^s	+27 24 10.57 [°]
1	4 55 35.757 ^s	25 36 16.62 [°]	1	6 53 27.857 ^s	27 22 30.77 [°]
2	4 57 55.091 ^s	25 41 59.98 [°]	2	6 56 01.349 ^s	27 20 40.32 [°]
3	5 00 14.824 ^s	25 47 35.47 [°]	3	6 58 34.973 ^s	27 18 39.19 [°]
4	5 02 34.954 ^s	25 53 03.00 [°]	4	7 01 08.722 ^s	27 16 27.35 [°]
5	5 04 55.480 ^s	25 58 22.52 [°]	5	7 03 42.587 ^s	27 14 04.79 [°]
6	5 07 16.398 ^s	26 03 33.93 [°]	6	7 06 16.561 ^s	27 11 31.48 [°]
7	5 09 37.706 ^s	26 08 37.16 [°]	7	7 08 50.634 ^s	27 08 47.41 [°]
8	5 11 59.402 ^s	26 13 32.13 [°]	8	7 11 24.799 ^s	27 05 52.55 [°]
9	5 14 21.483 ^s	26 18 18.78 [°]	9	7 13 59.047 ^s	27 02 46.90 [°]
10	5 16 43.945 ^s	26 22 57.02 [°]	10	7 16 33.370 ^s	26 59 30.45 [°]
11	5 19 06.786 ^s	26 27 26.78 [°]	11	7 19 07.759 ^s	26 56 03.17 [°]
12	5 21 30.002 ^s	26 31 47.98 [°]	12	7 21 42.207 ^s	26 52 25.07 [°]
13	5 23 53.589 ^s	26 36 00.56 [°]	13	7 24 16.704 ^s	26 48 36.13 [°]
14	5 26 17.545 ^s	26 40 04.44 [°]	14	7 26 51.243 ^s	26 44 36.36 [°]
15	5 28 41.864 ^s	26 43 59.54 [°]	15	7 29 25.814 ^s	26 40 25.76 [°]
16	5 31 06.544 ^s	26 47 45.79 [°]	16	7 32 00.411 ^s	26 36 04.31 [°]
17	5 33 31.579 ^s	26 51 23.13 [°]	17	7 34 35.025 ^s	26 31 32.04 [°]
18	5 35 56.966 ^s	26 54 51.48 [°]	18	7 37 09.647 ^s	26 26 48.93 [°]
19	5 38 22.700 ^s	26 58 10.77 [°]	19	7 39 44.269 ^s	26 21 55.00 [°]
20	5 40 48.777 ^s	27 01 20.94 [°]	20	7 42 18.884 ^s	26 16 50.26 [°]
21	5 43 15.191 ^s	27 04 21.91 [°]	21	7 44 53.483 ^s	26 11 34.72 [°]
22	5 45 41.938 ^s	27 07 13.61 [°]	22	7 47 28.058 ^s	26 06 08.39 [°]
23	5 48 09.012 ^s	27 09 55.98 [°]	23	7 50 02.602 ^s	26 00 31.29 [°]
24	5 50 36.409 ^s	+27 12 28.96 [°]	24	7 52 37.106 ^s	+25 54 43.44 [°]
	147.397	+152.98		154.504	-347.85

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
February 22							February 24						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	7 52	37	106	154°457	+25 54	43·44	0	9 53	23	553	145°633	+18 00	17·46
1	7 55	11	563	154°402	25 48	44·85	1	9 55	49	186	145°377	17 46	47·35
2	7 57	45	965	154°340	25 42	35·55	2	9 58	14	563	145°120	17 33	09·88
3	8 00	20	305	154°270	25 36	15·56	3	10 00	39	683	144°863	17 19	25·14
4	8 02	54	575	154°193	25 29	44·92	4	10 03	04	546	144°606	17 05	33·26
5	8 05	28	768	154°109	25 23	03·65	5	10 05	29	152	144°350	16 51	34·32
6	8 08	02	877	154°017	25 16	11·77	6	10 07	53	502	144°094	16 37	28·45
7	8 10	36	894	153°918	25 09	09·33	7	10 10	17	596	143°838	16 23	15·75
8	8 13	10	812	153°813	25 01	56·36	8	10 12	41	434	143°583	16 08	56·34
9	8 15	44	625	153°701	24 54	32·90	9	10 15	05	017	143°328	15 54	30·32
10	8 18	18	326	153°581	24 46	58·99	10	10 17	28	345	143°075	15 39	57·81
11	8 20	51	907	153°456	24 39	14·66	11	10 19	51	420	142°823	15 25	18·91
12	8 23	25	363	153°325	24 31	19·97	12	10 22	14	243	142°571	15 10	33·76
13	8 25	58	688	153°186	24 23	14·96	13	10 24	36	814	142°321	14 55	42·45
14	8 28	31	874	153°041	24 14	59·68	14	10 26	59	135	142°073	14 40	45·11
15	8 31	04	915	152°891	24 06	34·17	15	10 29	21	208	141°826	14 25	41·84
16	8 33	37	806	152°736	23 57	58·49	16	10 31	43	034	141°581	14 10	32·78
17	8 36	10	542	152°573	23 49	12·70	17	10 34	04	615	141°337	13 55	18·02
18	8 38	43	115	152°406	23 40	16·85	18	10 36	25	952	141°095	13 39	57·70
19	8 41	15	521	152°234	23 31	11·00	19	10 38	47	047	140°856	13 24	31·92
20	8 43	47	755	152°055	23 21	55·20	20	10 41	07	903	140·618	13 09	00·81
21	8 46	19	810	151°873	23 12	29·53	21	10 43	28	521	140·383	12 53	24·49
22	8 48	51	683	151°685	23 02	54·05	22	10 45	48	904	140·151	12 37	43·07
23	8 51	23	368	151·492	+22 53	08·81	23	10 48	09	055	139·920	+12 21	56·68
						-594·91							-951·25
February 23							February 25						
0	8 53	54	860	151·295	+22 43	13·90	0	10 50	28	975	139·692	+12 06	05·43
1	8 56	26	155	151·093	22 33	09·37	1	10 52	48	667	139·466	11 50	09·45
2	8 58	57	248	150·888	22 22	55·31	2	10 55	08	133	139·244	11 34	08·85
3	9 01	28	136	150·678	22 12	31·77	3	10 57	27	377	139·025	11 18	03·76
4	9 03	58	814	150·464	22 01	58·85	4	10 59	46	402	138·808	11 01	54·30
5	9 06	29	278	150·247	21 51	16·61	5	11 02	05	210	138·594	10 45	40·58
6	9 08	59	525	150·025	21 40	25·13	6	11 04	23	804	138·383	10 29	22·74
7	9 11	29	550	149·801	21 29	24·50	7	11 06	42	187	138·176	10 13	00·89
8	9 13	59	351	149·574	21 18	14·79	8	11 09	00	363	137·972	9 56	35·16
9	9 16	28	925	149·343	21 06	56·08	9	11 11	18	335	137·770	9 40	05·67
10	9 18	58	268	149·110	20 55	28·47	10	11 13	36	105	137·573	9 23	32·53
11	9 21	27	378	148·873	20 43	52·04	11	11 15	53	678	137·380	9 06	55·88
12	9 23	56	251	148·634	20 32	06·87	12	11 18	11	058	137·188	8 50	15·84
13	9 26	24	885	148·394	20 20	13·06	13	11 20	28	246	137·002	8 33	32·52
14	9 28	53	279	148·150	20 08	10·70	14	11 22	45	248	136·819	8 16	46·05
15	9 31	21	429	147·904	19 55	59·87	15	11 25	02	067	136·639	7 59	56·56
16	9 33	49	333	147·658	19 43	40·68	16	11 27	18	706	136·464	7 43	04·16
17	9 36	16	991	147·409	19 31	13·21	17	11 29	35	170	136·292	7 26	08·98
18	9 38	44	400	147·158	19 18	37·56	18	11 31	51	462	136·124	7 09	11·14
19	9 41	11	558	146·907	19 05	53·83	19	11 34	07	586	135·960	6 52	10·77
20	9 43	38	465	146·653	18 53	02·12	20	11 36	23	546	135·801	6 35	07·98
21	9 46	05	118	146·400	18 40	02·52	21	11 38	39	347	135·644	6 18	02·90
22	9 48	31	518	146·145	18 26	55·15	22	11 40	54	991	135·494	6 00	55·65
23	9 50	57	663	145·890	18 13	40·09	23	11 43	10	485	135·345	5 43	46·35
24	9 53	23	553		+18 00	17·46	24	11 45	25	830		+ 5 26	35·13
						-802·63							-1031·22

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
February 26			February 28		
0	11 45 25.830 ^s 135.203	+ 0 26 35.13 ^s -1033.02	0	13 32 16.637 ^s 133.621	- 8 17 31.74 ^s -982.94
1	11 47 41.033 ^s 135.063	5 09 22.11 ^s 1034.71	1	13 34 30.258 ^s 133.696	8 33 54.68 ^s 979.24
2	11 49 56.096 ^s 134.929	4 52 07.40 ^s 1036.27	2	13 36 43.954 ^s 133.775	8 50 13.92 ^s 975.44
3	11 52 11.025 ^s 134.798	4 34 51.13 ^s 1037.70	3	13 38 57.729 ^s 133.858	9 06 29.36 ^s 971.53
4	11 54 25.823 ^s 134.672	4 17 33.43 ^s 1039.03	4	13 41 11.587 ^s 133.945	9 22 40.89 ^s 967.53
5	11 56 40.495 ^s 134.551	4 00 14.40 ^s 1040.22	5	13 43 25.532 ^s 134.035	9 38 48.42 ^s 963.43
6	11 58 55.046 ^s 134.434	3 42 54.18 ^s 1041.30	6	13 45 39.567 ^s 134.131	9 54 51.85 ^s 959.24
7	12 01 09.480 ^s 134.320	3 25 32.88 ^s 1042.26	7	13 47 53.698 ^s 134.228	10 10 51.09 ^s 954.94
8	12 03 23.800 ^s 134.213	3 08 10.62 ^s 1043.09	8	13 50 07.926 ^s 134.330	10 26 46.03 ^s 950.55
9	12 05 38.013 ^s 134.109	2 50 47.53 ^s 1043.82	9	13 52 22.256 ^s 134.436	10 42 36.58 ^s 946.07
10	12 07 52.122 ^s 134.009	2 33 23.71 ^s 1044.41	10	13 54 36.692 ^s 134.545	10 58 22.65 ^s 941.49
11	12 10 06.131 ^s 133.915	2 15 59.30 ^s 1044.89	11	13 56 51.237 ^s 134.657	11 14 04.14 ^s 936.81
12	12 12 20.046 ^s 133.824	1 58 34.41 ^s 1045.25	12	13 59 05.894 ^s 134.773	11 29 40.95 ^s 932.05
13	12 14 33.870 ^s 133.739	1 41 09.16 ^s 1045.49	13	14 01 20.667 ^s 134.893	11 45 13.00 ^s 927.19
14	12 16 47.609 ^s 133.658	1 23 43.67 ^s 1045.62	14	14 03 35.560 ^s 135.014	12 00 40.19 ^s 922.23
15	12 19 01.267 ^s 133.581	1 06 18.05 ^s 1045.63	15	14 05 50.574 ^s 135.141	12 16 02.42 ^s 917.20
16	12 21 14.848 ^s 133.510	0 48 52.42 ^s 1045.52	16	14 08 05.715 ^s 135.269	12 31 19.62 ^s 912.05
17	12 23 28.358 ^s 133.442	0 31 26.90 ^s 1045.29	17	14 10 20.984 ^s 135.402	12 46 31.67 ^s 906.84
18	12 25 41.800 ^s 133.380	+ 0 14 01.61 ^s 1044.95	18	14 12 36.386 ^s 135.536	13 01 38.51 ^s 901.52
19	12 27 55.180 ^s 133.322	- 0 03 23.34 ^s 1044.49	19	14 14 51.922 ^s 135.674	13 16 40.03 ^s 896.11
20	12 30 08.502 ^s 133.269	0 20 47.83 ^s 1043.91	20	14 17 07.596 ^s 135.815	13 31 36.14 ^s 890.62
21	12 32 21.771 ^s 133.220	0 38 11.74 ^s 1043.23	21	14 19 23.411 ^s 135.958	13 46 26.76 ^s 885.05
22	12 34 34.991 ^s 133.176	0 55 34.97 ^s 1042.42	22	14 21 39.369 ^s 136.104	14 01 11.81 ^s 879.38
23	12 36 48.167 ^s 133.137	- 1 12 57.39 ^s -1041.51	23	14 23 55.473 ^s 136.253	-14 15 51.19 ^s -873.62
February 27			March 1		
0	12 39 01.304 ^s 133.102	- 1 30 18.90 ^s -1040.48	0	14 26 11.726 ^s 136.405	-14 30 24.81 ^s -867.79
1	12 41 14.406 ^s 133.072	1 47 39.38 ^s 1039.33	1	14 28 28.131 ^s 136.558	14 44 52.60 ^s 861.86
2	12 43 27.478 ^s 133.046	2 04 58.71 ^s 1038.07	2	14 30 44.689 ^s 136.714	14 59 14.46 ^s 855.85
3	12 45 40.524 ^s 133.025	2 22 16.78 ^s 1036.71	3	14 33 01.403 ^s 136.872	15 13 30.31 ^s 849.77
4	12 47 53.549 ^s 133.010	2 39 33.49 ^s 1035.22	4	14 35 18.275 ^s 137.033	15 27 40.08 ^s 843.59
5	12 50 06.559 ^s 132.997	2 56 48.71 ^s 1033.63	5	14 37 35.308 ^s 137.196	15 41 43.67 ^s 837.33
6	12 52 19.556 ^s 132.991	3 14 02.34 ^s 1031.93	6	14 39 52.504 ^s 137.359	15 55 41.00 ^s 830.99
7	12 54 32.547 ^s 132.987	3 31 14.27 ^s 1030.12	7	14 42 09.863 ^s 137.527	16 09 31.99 ^s 824.58
8	12 56 45.534 ^s 132.990	3 48 24.39 ^s 1028.19	8	14 44 27.390 ^s 137.694	16 23 16.57 ^s 818.07
9	12 58 58.524 ^s 132.997	4 05 32.58 ^s 1026.16	9	14 46 45.084 ^s 137.865	16 36 54.64 ^s 811.50
10	13 01 11.521 ^s 133.007	4 22 38.74 ^s 1024.02	10	14 49 02.949 ^s 138.036	16 50 26.14 ^s 804.84
11	13 03 24.528 ^s 133.023	4 39 42.76 ^s 1021.77	11	14 51 20.985 ^s 138.208	17 03 50.98 ^s 798.11
12	13 05 37.551 ^s 133.043	4 56 44.53 ^s 1019.42	12	14 53 39.193 ^s 138.383	17 17 09.09 ^s 791.29
13	13 07 50.594 ^s 133.068	5 13 43.95 ^s 1016.95	13	14 55 57.576 ^s 138.559	17 30 20.38 ^s 784.41
14	13 10 03.662 ^s 133.096	5 30 40.90 ^s 1014.38	14	14 58 16.135 ^s 138.736	17 43 24.79 ^s 777.44
15	13 12 16.758 ^s 133.130	5 47 35.28 ^s 1011.70	15	15 00 34.871 ^s 138.913	17 56 22.23 ^s 770.40
16	13 14 29.888 ^s 133.167	6 04 26.98 ^s 1008.92	16	15 02 53.784 ^s 139.092	18 09 12.63 ^s 763.29
17	13 16 43.055 ^s 133.209	6 21 15.90 ^s 1006.04	17	15 05 12.876 ^s 139.272	18 21 55.92 ^s 756.10
18	13 18 56.264 ^s 133.256	6 38 01.94 ^s 1003.04	18	15 07 32.148 ^s 139.452	18 34 32.02 ^s 748.84
19	13 21 09.520 ^s 133.305	6 54 44.98 ^s 999.95	19	15 09 51.600 ^s 139.634	18 47 00.86 ^s 741.52
20	13 23 22.825 ^s 133.361	7 11 24.93 ^s 996.76	20	15 12 11.234 ^s 139.814	18 59 22.38 ^s 734.11
21	13 25 36.186 ^s 133.419	7 28 01.69 ^s 993.45	21	15 14 31.048 ^s 139.997	19 11 36.49 ^s 726.64
22	13 27 49.605 ^s 133.483	7 44 35.14 ^s 990.05	22	15 16 51.045 ^s 140.179	19 23 43.13 ^s 719.09
23	13 30 03.088 ^s 133.549	8 01 05.19 ^s -986.55	23	15 19 11.224 ^s 140.361	19 35 42.22 ^s -711.49
24	13 32 16.637 ^s	- 8 17 31.74 ^s	24	15 21 31.585 ^s	-19 47 33.71 ^s

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
March 2			March 4		
h	h m s	° ' "	h	h m s	° ' "
0	15 21 31.585 ^s 140.543	-19 47 33.71 ["] -703.82	0	17 16 55.136 ^s 146.892	-26 29 13.52 ["] -275.29
1	15 23 52.128 ^s 140.726	19 59 17.53 ["] 696.07	1	17 19 22.028 ^s 146.927	26 33 48.81 ["] 265.57
2	15 26 12.854 ^s 140.907	20 10 53.60 ["] 688.26	2	17 21 48.955 ^s 146.955	26 38 14.38 ["] 255.86
3	15 28 33.761 ^s 141.090	20 22 21.86 ["] 680.38	3	17 24 15.910 ^s 146.978	26 42 30.24 ["] 246.12
4	15 30 54.851 ^s 141.270	20 33 42.24 ["] 672.45	4	17 26 42.888 ^s 146.995	26 46 36.36 ["] 236.38
5	15 33 16.121 ^s 141.451	20 44 54.69 ["] 664.44	5	17 29 09.883 ^s 147.006	26 50 32.74 ["] 226.64
6	15 35 37.572 ^s 141.632	20 55 59.13 ["] 656.39	6	17 31 36.889 ^s 147.012	26 54 19.38 ["] 216.88
7	15 37 59.204 ^s 141.810	21 06 55.52 ["] 648.25	7	17 34 03.901 ^s 147.011	26 57 56.26 ["] 207.13
8	15 40 21.014 ^s 141.988	21 17 43.77 ["] 640.07	8	17 36 30.912 ^s 147.004	27 01 23.39 ["] 197.37
9	15 42 43.002 ^s 142.166	21 28 23.84 ["] 631.83	9	17 38 57.916 ^s 146.992	27 04 40.76 ["] 187.61
10	15 45 05.168 ^s 142.342	21 38 55.67 ["] 623.52	10	17 41 24.908 ^s 146.973	27 07 48.37 ["] 177.86
11	15 47 27.510 ^s 142.516	21 49 19.19 ["] 615.16	11	17 43 51.881 ^s 146.948	27 10 46.23 ["] 168.09
12	15 49 50.026 ^s 142.689	21 59 34.35 ["] 606.74	12	17 46 18.829 ^s 146.918	27 13 34.32 ["] 158.35
13	15 52 12.715 ^s 142.860	22 09 41.09 ["] 598.27	13	17 48 45.747 ^s 146.881	27 16 12.67 ["] 148.59
14	15 54 35.575 ^s 143.030	22 19 39.36 ["] 589.74	14	17 51 12.628 ^s 146.837	27 18 41.26 ["] 138.85
15	15 56 58.605 ^s 143.199	22 29 29.10 ["] 581.15	15	17 53 39.465 ^s 146.788	27 21 00.11 ["] 129.12
16	15 59 21.804 ^s 143.364	22 39 10.25 ["] 572.53	16	17 56 06.253 ^s 146.732	27 23 09.23 ["] 119.39
17	16 01 45.168 ^s 143.527	22 48 42.78 ["] 563.83	17	17 58 32.985 ^s 146.671	27 25 08.62 ["] 109.67
18	16 04 08.695 ^s 143.690	22 58 06.61 ["] 555.11	18	18 00 59.656 ^s 146.603	27 26 58.29 ["] 99.97
19	16 06 32.385 ^s 143.848	23 07 21.72 ["] 546.31	19	18 03 26.259 ^s 146.528	27 28 38.26 ["] 90.27
20	16 08 56.233 ^s 144.005	23 16 28.03 ["] 537.48	20	18 05 52.787 ^s 146.448	27 30 08.53 ["] 80.59
21	16 11 20.238 ^s 144.160	23 25 25.51 ["] 528.61	21	18 08 19.235 ^s 146.361	27 31 29.12 ["] 70.93
22	16 13 44.398 ^s 144.310	23 34 14.12 ["] 519.67	22	18 10 45.596 ^s 146.268	27 32 40.05 ["] 61.29
23	16 16 08.708 ^s 144.459	-23 42 53.79 ["] -510.70	23	18 13 11.864 ^s 146.169	-27 33 41.34 ["] -51.65
March 3			March 5		
0	16 18 33.167 ^s 144.605	-23 51 24.49 ["] -501.69	0	18 15 38.033 ^s 146.063	-27 34 32.99 ["] -42.05
1	16 20 57.772 ^s 144.746	23 59 46.18 ["] 492.62	1	18 18 04.096 ^s 145.953	27 35 15.04 ["] 32.45
2	16 23 22.518 ^s 144.886	24 07 58.80 ["] 483.53	2	18 20 30.049 ^s 145.834	27 35 47.49 ["] 22.89
3	16 25 47.404 ^s 145.021	24 16 02.33 ["] 474.38	3	18 22 55.883 ^s 145.711	27 36 10.38 ["] 13.35
4	16 28 12.425 ^s 145.154	24 23 56.71 ["] 465.21	4	18 25 21.594 ^s 145.581	27 36 23.73 ["] 3.83
5	16 30 37.579 ^s 145.282	24 31 41.92 ["] 455.99	5	18 27 47.175 ^s 145.444	27 36 27.56 ["] -5.66
6	16 33 02.861 ^s 145.407	24 39 17.91 ["] 446.73	6	18 30 12.619 ^s 145.304	27 36 21.90 ["] -15.13
7	16 35 28.268 ^s 145.528	24 46 44.64 ["] 437.45	7	18 32 37.923 ^s 145.155	27 36 06.77 ["] -24.57
8	16 37 53.796 ^s 145.645	24 54 02.09 ["] 428.11	8	18 35 03.078 ^s 145.001	27 35 42.20 ["] -33.98
9	16 40 19.441 ^s 145.758	25 01 10.20 ["] 418.76	9	18 37 28.079 ^s 144.842	27 35 08.22 ["] -43.35
10	16 42 45.199 ^s 145.867	25 08 08.96 ["] 409.38	10	18 39 52.921 ^s 144.676	27 34 24.87 ["] -52.70
11	16 45 11.066 ^s 145.971	25 14 58.34 ["] 399.95	11	18 42 17.597 ^s 144.505	27 33 32.17 ["] -62.01
12	16 47 37.037 ^s 146.071	25 21 38.29 ["] 390.50	12	18 44 42.102 ^s 144.329	27 32 30.16 ["] -71.29
13	16 50 03.108 ^s 146.167	25 28 08.79 ["] 381.02	13	18 47 06.431 ^s 144.145	27 31 18.87 ["] -80.54
14	16 52 29.275 ^s 146.258	25 34 29.81 ["] 371.52	14	18 49 30.576 ^s 143.958	27 29 58.33 ["] -89.74
15	16 54 55.533 ^s 146.344	25 40 41.33 ["] 361.99	15	18 51 54.534 ^s 143.764	27 28 28.59 ["] -98.91
16	16 57 21.877 ^s 146.425	25 46 43.32 ["] 352.43	16	18 54 18.298 ^s 143.565	27 26 49.68 ["] -108.04
17	16 59 48.302 ^s 146.502	25 52 35.75 ["] 342.86	17	18 56 41.863 ^s 143.360	27 25 01.64 ["] -117.13
18	17 02 14.804 ^s 146.573	25 58 18.61 ["] 333.26	18	18 59 05.223 ^s 143.151	27 23 04.51 ["] -126.18
19	17 04 41.377 ^s 146.640	26 03 51.87 ["] 323.64	19	19 01 28.374 ^s 142.937	27 20 58.33 ["] -135.20
20	17 07 08.017 ^s 146.701	26 09 15.51 ["] 314.00	20	19 03 51.311 ^s 142.716	27 18 43.13 ["] -144.15
21	17 09 34.718 ^s 146.757	26 14 29.51 ["] 304.35	21	19 06 14.027 ^s 142.491	27 16 18.98 ["] -153.08
22	17 12 01.475 ^s 146.808	26 19 33.86 ["] 294.67	22	19 08 36.518 ^s 142.262	27 13 45.90 ["] -161.96
23	17 14 28.283 ^s 146.853	26 24 28.53 ["] -284.99	23	19 10 58.780 ^s 142.027	27 11 03.94 ["] -170.79
24	17 16 55.136 ^s	-26 29 13.52 ["]	24	19 13 20.807 ^s	-27 08 13.15 ["]

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
March 6							March 8						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	19	13	20.807	141.787	27	08 13.15	1	21	01 13.899	126.846	22	16 20.06	
1	19	15	42.594	141.543	27	05 13.57	1	21	03 20.745	126.508	22	07 26.01	
2	19	18	04.137	141.295	27	02 05.26	2	21	05 27.253	126.171	21	58 26.13	
3	19	20	25.432	141.042	26	58 48.26	3	21	07 33.424	126.171	21	49 20.49	
4	19	22	46.474	140.784	26	55 22.61	4	21	09 39.259	125.835	21	40 09.15	
5	19	25	07.258	140.522	26	51 48.37	5	21	11 44.758	125.499	21	30 52.17	
6	19	27	27.780	140.257	26	48 05.60	6	21	13 49.922	125.164	21	21 29.62	
7	19	29	48.037	139.987	26	44 14.33	7	21	15 54.752	124.830	21	12 01.57	
8	19	32	08.024	139.713	26	40 14.63	8	21	17 59.249	124.497	21	02 28.09	
9	19	34	27.737	139.436	26	36 06.55	9	21	20 03.415	124.166	20	52 49.23	
10	19	36	47.173	139.155	26	31 50.13	10	21	22 07.250	123.835	20	43 05.07	
11	19	39	06.328	138.869	26	27 25.45	11	21	24 10.756	123.506	20	33 15.66	
12	19	41	25.197	138.582	26	22 52.54	12	21	26 13.934	123.178	20	23 21.08	
13	19	43	43.779	138.289	26	18 11.46	13	21	28 16.786	122.852	20	13 21.38	
14	19	46	02.068	137.995	26	13 22.28	14	21	30 19.313	122.527	20	03 16.64	
15	19	48	20.063	137.696	26	08 25.05	15	21	32 21.517	122.204	19	53 06.91	
16	19	50	37.759	137.396	26	03 19.83	16	21	34 23.399	121.882	19	42 52.26	
17	19	52	55.155	137.091	25	58 06.67	17	21	36 24.962	121.563	19	32 32.76	
18	19	55	12.246	136.785	25	52 45.64	18	21	38 26.206	121.244	19	22 08.47	
19	19	57	29.031	136.475	25	47 16.79	19	21	40 27.134	120.928	19	11 39.45	
20	19	59	45.506	136.164	25	41 40.18	20	21	42 27.748	120.614	19	01 05.76	
21	20	02	01.670	135.848	25	35 55.88	21	21	44 28.050	120.302	18	50 27.47	
22	20	04	17.518	135.532	25	30 03.94	22	21	46 28.042	119.992	18	39 44.65	
23	20	06	33.050	135.213	25	24 04.42	23	21	48 27.725	119.683	18	28 57.35	
										119.378			
March 7							March 9						
0	20	08	48.263	134.892	25	17 57.39	0	21	50 27.103	119.073	18	18 05.64	
1	20	11	03.155	134.568	25	11 42.91	1	21	52 26.176	118.773	18	07 09.58	
2	20	13	17.723	134.244	25	05 21.05	2	21	54 24.949	118.473	17	56 09.23	
3	20	15	31.967	133.917	24	58 51.85	3	21	56 23.422	118.176	17	45 04.65	
4	20	17	45.884	133.588	24	52 15.39	4	21	58 21.598	117.882	17	33 55.91	
5	20	19	59.472	133.259	24	45 31.74	5	22	00 19.480	117.591	17	22 43.07	
6	20	22	12.731	132.927	24	38 40.94	6	22	02 17.071	117.301	17	11 26.18	
7	20	24	25.658	132.595	24	31 43.07	7	22	04 14.372	117.014	17	00 05.32	
8	20	26	38.253	132.261	24	24 38.20	8	22	06 11.386	116.730	16	48 40.53	
9	20	28	50.514	131.926	24	17 26.38	9	22	08 08.116	116.449	16	37 11.88	
10	20	31	02.440	131.591	24	10 07.68	10	22	10 04.565	116.170	16	25 39.44	
11	20	33	14.031	131.253	24	02 42.16	11	22	12 00.735	115.895	16	14 03.25	
12	20	35	25.284	130.916	23	55 09.90	12	22	13 56.630	115.621	16	02 23.38	
13	20	37	36.200	130.579	23	47 30.95	13	22	15 52.251	115.350	15	50 39.90	
14	20	39	46.779	130.239	23	39 45.38	14	22	17 47.601	115.083	15	38 52.85	
15	20	41	57.018	129.901	23	31 53.26	15	22	19 42.684	114.819	15	27 02.29	
16	20	44	06.919	129.561	23	23 54.65	16	22	21 37.503	114.557	15	15 08.30	
17	20	46	16.480	129.221	23	15 49.62	17	22	23 32.060	114.299	15	03 10.91	
18	20	48	25.701	128.882	23	07 38.23	18	22	25 26.359	114.042	14	51 10.20	
19	20	50	34.583	128.542	22	59 20.54	19	22	27 20.401	113.791	14	39 06.22	
20	20	52	43.125	128.203	22	50 56.64	20	22	29 14.192	113.540	14	26 59.02	
21	20	54	51.328	127.862	22	42 26.57	21	22	31 07.732	113.295	14	14 48.67	
22	20	56	59.190	127.524	22	33 50.41	22	22	33 01.027	113.051	14	02 35.22	
23	20	59	06.714	127.185	22	25 08.22	23	22	34 54.078	112.811	13	50 18.72	
24	21	01	13.899		22	16 20.06	24	22	36 46.889		13	37 59.24	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
March 14							March 16						
h	b	m	s	°	'	"	h	b	m	s	°	'	"
0	1	27	39.797	106.735	+ 7	48 41.93	0	2	56	27.135	116.819	+17	40 17.24
1	1	29	26.532	106.859	8	01 57.07	1	2	58	23.954	117.111	17	51 19.20
2	1	31	13.391	106.986	8	15 10.56	2	3	00	21.065	117.408	18	02 17.11
3	1	33	00.377	107.118	8	28 22.37	3	3	02	18.473	117.707	18	13 10.91
4	1	34	47.495	107.253	8	41 32.43	4	3	04	16.180	117.907	18	24 00.56
5	1	36	34.748	107.392	8	54 40.72	5	3	06	14.190	118.010	18	34 45.98
6	1	38	22.140	107.535	9	07 47.18	6	3	08	12.504	118.314	18	45 27.13
7	1	40	09.675	107.681	9	20 51.77	7	3	10	11.126	118.622	18	56 03.95
8	1	41	57.356	107.832	9	33 54.44	8	3	12	10.059	118.933	19	06 36.37
9	1	43	45.188	107.986	9	46 55.15	9	3	14	09.304	119.245	19	17 04.34
10	1	45	33.174	108.143	9	59 53.85	10	3	16	08.865	119.561	19	27 27.81
11	1	47	21.317	108.306	10	12 50.49	11	3	18	08.745	119.880	19	37 46.70
12	1	49	09.623	108.470	10	25 45.02	12	3	20	08.945	120.200	19	48 00.96
13	1	50	58.093	108.640	10	38 37.41	13	3	22	09.469	120.524	19	58 10.54
14	1	52	46.733	108.813	10	51 27.60	14	3	24	10.318	120.849	20	08 15.36
15	1	54	35.546	108.990	11	04 15.54	15	3	26	11.495	121.177	20	18 15.38
16	1	56	24.536	109.170	11	17 01.20	16	3	28	13.003	121.508	20	28 10.52
17	1	58	13.706	109.354	11	29 44.51	17	3	30	14.843	121.840	20	38 00.73
18	2	00	03.060	109.542	11	42 25.44	18	3	32	17.018	122.175	20	47 45.95
19	2	01	52.602	109.734	11	55 03.93	19	3	34	19.529	122.511	20	57 26.12
20	2	03	42.336	109.928	12	07 39.95	20	3	36	22.380	122.851	21	07 01.16
21	2	05	32.264	110.128	12	20 13.43	21	3	38	25.571	123.191	21	16 31.03
22	2	07	22.392	110.330	12	32 44.33	22	3	40	29.106	123.535	21	25 55.66
23	2	09	12.722	110.536	+12	45 12.60	23	3	42	32.984	123.878	+21	35 14.98
						+745.59				124.225			+553.95
March 15							March 17						
0	2	11	03.258	110.746	+12	57 38.19	0	3	44	37.209	124.573	+21	44 28.93
1	2	12	54.004	110.960	13	10 01.06	1	3	46	41.782	124.923	21	53 37.45
2	2	14	44.964	111.176	13	22 21.15	2	3	48	46.705	125.274	22	02 40.47
3	2	16	36.140	111.397	13	34 38.42	3	3	50	51.979	125.626	22	11 37.94
4	2	18	27.537	111.622	13	46 52.80	4	3	52	57.605	125.980	22	20 29.78
5	2	20	19.159	111.849	13	59 04.27	5	3	55	03.585	126.335	22	29 15.93
6	2	22	11.008	112.080	14	11 12.75	6	3	57	09.920	126.692	22	37 56.33
7	2	24	03.088	112.315	14	23 18.21	7	3	59	16.612	127.050	22	46 30.91
8	2	25	55.403	112.553	14	35 20.59	8	4	01	23.662	127.408	22	54 59.61
9	2	27	47.956	112.795	14	47 19.84	9	4	03	31.070	127.767	23	03 22.36
10	2	29	40.751	113.039	14	59 15.91	10	4	05	38.837	127.967	23	11 39.10
11	2	31	33.790	113.289	15	11 08.75	11	4	07	46.965	128.128	23	19 49.76
12	2	33	27.079	113.540	15	22 58.30	12	4	09	55.454	128.489	23	27 54.27
13	2	35	20.619	113.796	15	34 44.51	13	4	12	04.304	128.850	23	35 52.57
14	2	37	14.415	114.054	15	46 27.33	14	4	14	13.517	129.213	23	43 44.59
15	2	39	08.469	114.317	15	58 06.71	15	4	16	23.093	129.576	23	51 30.27
16	2	41	02.786	114.581	16	09 42.59	16	4	18	33.031	129.938	23	59 09.54
17	2	42	57.367	114.850	16	21 14.92	17	4	20	43.333	130.302	24	06 42.33
18	2	44	52.217	115.122	16	32 43.64	18	4	22	53.999	130.666	24	14 08.58
19	2	46	47.339	115.397	16	44 08.71	19	4	25	05.028	131.029	24	21 28.22
20	2	48	42.736	115.675	16	55 30.06	20	4	27	16.420	131.392	24	28 41.18
21	2	50	38.411	115.956	17	06 47.65	21	4	29	28.176	131.756	24	35 47.40
22	2	52	34.367	116.240	17	18 01.41	22	4	31	40.295	132.119	24	42 46.81
23	2	54	30.607	116.528	17	29 11.29	23	4	33	52.776	132.481	24	49 39.33
24	2	56	27.135		+17	40 17.24	24	4	36	05.619	132.843	+24	56 24.92
						+665.95							+405.59

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
March 18			March 20		
0	4 36 05.619 133.205	+24 56 24.92 +398.57	0	6 28 47.502 147.425	+27 43 47.74 10.92
1	4 38 18.824 133.565	25 03 03.49 391.49	1	6 31 14.927 147.608	27 43 36.82 20.72
2	4 40 32.389 133.926	25 09 34.98 384.35	2	6 33 42.535 147.785	27 43 16.10 30.56
3	4 42 46.315 134.284	25 15 59.33 377.14	3	6 36 10.320 147.956	27 42 45.54 40.43
4	4 45 00.599 134.642	25 22 16.47 369.86	4	6 38 38.276 148.121	27 42 05.11 50.33
5	4 47 15.241 134.998	25 28 26.33 362.51	5	6 41 06.397 148.278	27 41 14.78 60.26
6	4 49 30.239 135.354	25 34 28.84 355.10	6	6 43 34.675 148.429	27 40 14.52 70.23
7	4 51 45.593 135.707	25 40 23.94 347.62	7	6 46 03.104 148.575	27 39 04.29 80.22
8	4 54 01.300 136.060	25 46 11.56 340.08	8	6 48 31.679 148.712	27 37 44.07 90.25
9	4 56 17.360 136.410	25 51 51.64 332.47	9	6 51 00.391 148.845	27 36 13.82 100.30
10	4 58 33.770 136.759	25 57 24.11 324.79	10	6 53 29.236 148.969	27 34 33.52 110.36
11	5 00 50.529 137.106	26 02 48.90 317.05	11	6 55 58.205 149.089	27 32 43.16 120.47
12	5 03 07.635 137.450	26 08 05.95 309.24	12	6 58 27.294 149.200	27 30 42.69 130.58
13	5 05 25.085 137.793	26 13 15.19 301.38	13	7 00 56.494 149.305	27 28 32.11 140.73
14	5 07 42.878 138.132	26 18 16.57 293.44	14	7 03 25.799 149.403	27 26 11.38 150.88
15	5 10 01.010 138.470	26 23 10.01 285.43	15	7 05 55.202 149.495	27 23 40.50 161.06
16	5 12 19.480 138.806	26 27 55.44 277.37	16	7 08 24.697 149.580	27 20 59.44 171.25
17	5 14 38.286 139.137	26 32 32.81 269.25	17	7 10 54.277 149.658	27 18 08.19 181.45
18	5 16 57.423 139.467	26 37 02.06 261.05	18	7 13 23.935 149.730	27 15 06.74 191.68
19	5 19 16.890 139.794	26 41 23.11 252.80	19	7 15 53.665 149.794	27 11 55.06 201.90
20	5 21 36.684 140.116	26 45 35.91 244.49	20	7 18 23.459 149.852	27 08 33.16 212.14
21	5 23 56.800 140.437	26 49 40.40 236.10	21	7 20 53.311 149.904	27 05 01.02 222.39
22	5 26 17.237 140.754	26 53 36.50 227.67	22	7 23 23.215 149.948	27 01 18.63 232.64
23	5 28 37.991 141.067	+26 57 24.17 +219.17	23	7 25 53.163 149.986	+26 57 25.99 -242.90
March 19			March 21		
0	5 30 59.058 141.376	+27 01 03.34 +210.61	0	7 28 23.149 150.017	+26 53 23.09 -253.16
1	5 33 20.434 141.683	27 04 33.95 201.99	1	7 30 53.166 150.042	26 49 09.93 263.43
2	5 35 42.117 141.985	27 07 55.94 193.31	2	7 33 23.208 150.060	26 44 46.50 273.68
3	5 38 04.102 142.282	27 11 09.25 184.57	3	7 35 53.268 150.072	26 40 12.82 283.95
4	5 40 26.384 142.577	27 14 13.82 175.78	4	7 38 23.340 150.077	26 35 28.87 294.20
5	5 42 48.961 142.867	27 17 09.60 166.93	5	7 40 53.417 150.076	26 30 34.67 304.45
6	5 45 11.828 143.152	27 19 56.53 158.02	6	7 43 23.493 150.068	26 25 30.22 314.69
7	5 47 34.980 143.433	27 22 34.55 149.06	7	7 45 53.561 150.054	26 20 15.53 324.93
8	5 49 58.413 143.709	27 25 03.61 140.04	8	7 48 23.615 150.033	26 14 50.60 335.16
9	5 52 22.122 143.982	27 27 23.65 130.97	9	7 50 53.648 150.008	26 09 15.44 345.36
10	5 54 46.104 144.248	27 29 34.62 121.85	10	7 53 23.656 149.974	26 03 30.08 355.57
11	5 57 10.352 144.510	27 31 36.47 112.67	11	7 55 53.630 149.937	25 57 34.51 365.75
12	5 59 34.862 144.768	27 33 29.14 103.44	12	7 58 23.567 149.891	25 51 28.76 375.91
13	6 01 59.630 145.019	27 35 12.58 94.16	13	8 00 53.458 149.842	25 45 12.85 386.06
14	6 04 24.649 145.266	27 36 46.74 84.84	14	8 03 23.300 149.785	25 38 46.79 396.19
15	6 06 49.915 145.507	27 38 11.58 75.46	15	8 05 53.085 149.723	25 32 10.60 406.29
16	6 09 15.422 145.744	27 39 27.04 66.04	16	8 08 22.808 149.656	25 25 24.31 416.37
17	6 11 41.166 145.974	27 40 33.08 56.56	17	8 10 52.464 149.583	25 18 27.94 426.43
18	6 14 07.140 146.199	27 41 29.64 47.06	18	8 13 22.047 149.505	25 11 21.51 436.45
19	6 16 33.339 146.417	27 42 16.70 37.49	19	8 15 51.552 149.421	25 04 05.06 446.45
20	6 18 59.756 146.631	27 42 54.19 27.89	20	8 18 20.973 149.332	24 56 38.61 456.41
21	6 21 26.387 146.839	27 43 22.08 18.25	21	8 20 50.305 149.238	24 49 02.20 466.35
22	6 23 53.226 147.040	27 43 40.33 8.57	22	8 23 19.543 149.139	24 41 15.85 476.25
23	6 26 20.266 147.236	27 43 48.90 -1.16	23	8 25 48.682 149.035	24 33 19.60 -486.12
24	6 28 47.502	+27 43 47.74	24	8 28 17.717	+24 25 13.48

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
March 22			March 24		
0	8 28 17.717 ^s 148.926	+24 25 13.48 ^s -495.94	0	10 24 26.312 ^s 140.714	+15 01 02.84 ^s -894.51
1	8 30 46.643 ^s 148.814	24 16 57.54 ^s 595.73	1	10 26 47.026 ^s 140.534	14 46 08.33 ^s 900.76
2	8 33 15.457 ^s 148.696	24 08 31.81 ^s 515.48	2	10 29 07.560 ^s 140.357	14 31 07.57 ^s 906.91
3	8 35 44.153 ^s 148.573	23 59 56.33 ^s 525.19	3	10 31 27.917 ^s 140.182	14 16 00.66 ^s 912.95
4	8 38 12.726 ^s 148.447	23 51 11.14 ^s 534.85	4	10 33 48.099 ^s 140.007	14 00 47.71 ^s 918.89
5	8 40 41.173 ^s 148.317	23 42 16.29 ^s 544.46	5	10 36 08.106 ^s 139.836	13 45 28.82 ^s 924.72
6	8 43 09.490 ^s 148.182	23 33 11.83 ^s 554.03	6	10 38 27.942 ^s 139.666	13 30 04.10 ^s 930.46
7	8 45 37.672 ^s 148.044	23 23 57.80 ^s 563.55	7	10 40 47.608 ^s 139.499	13 14 33.64 ^s 936.08
8	8 48 05.716 ^s 147.902	23 14 34.25 ^s 573.03	8	10 43 07.107 ^s 139.333	12 58 57.56 ^s 941.59
9	8 50 33.618 ^s 147.756	23 05 01.22 ^s 582.44	9	10 45 26.440 ^s 139.171	12 43 15.97 ^s 947.00
10	8 53 01.374 ^s 147.606	22 55 18.78 ^s 591.81	10	10 47 45.611 ^s 139.011	12 27 28.97 ^s 952.31
11	8 55 28.980 ^s 147.454	22 45 26.97 ^s 601.11	11	10 50 04.622 ^s 138.853	12 11 36.66 ^s 957.49
12	8 57 56.434 ^s 147.299	22 35 25.86 ^s 610.38	12	10 52 23.475 ^s 138.698	11 55 39.17 ^s 962.57
13	9 00 23.733 ^s 147.139	22 25 15.48 ^s 619.56	13	10 54 42.173 ^s 138.546	11 39 36.60 ^s 967.54
14	9 02 50.872 ^s 146.978	22 14 55.92 ^s 628.71	14	10 57 00.719 ^s 138.396	11 23 29.06 ^s 972.40
15	9 05 17.850 ^s 146.813	22 04 27.21 ^s 637.78	15	10 59 19.115 ^s 138.250	11 07 16.66 ^s 977.15
16	9 07 44.663 ^s 146.646	21 53 49.43 ^s 646.80	16	11 01 37.365 ^s 138.106	10 50 59.51 ^s 981.77
17	9 10 11.309 ^s 146.476	21 43 02.63 ^s 655.74	17	11 03 55.471 ^s 137.966	10 34 37.74 ^s 986.30
18	9 12 37.785 ^s 146.304	21 32 06.89 ^s 664.63	18	11 06 13.437 ^s 137.829	10 18 11.44 ^s 990.70
19	9 15 04.089 ^s 146.129	21 21 02.26 ^s 673.46	19	11 08 31.266 ^s 137.694	10 01 40.74 ^s 994.99
20	9 17 30.218 ^s 145.953	21 09 48.80 ^s 682.20	20	11 10 48.960 ^s 137.563	9 45 05.75 ^s 999.17
21	9 19 56.171 ^s 145.775	20 58 26.60 ^s 690.88	21	11 13 06.523 ^s 137.436	9 28 26.58 ^s 1003.22
22	9 22 21.946 ^s 145.595	20 46 55.72 ^s 699.49	22	11 15 23.959 ^s 137.312	9 11 43.36 ^s 1007.17
23	9 24 47.541 ^s 145.412	+20 35 16.23 ^s -708.04	23	11 17 41.271 ^s 137.191	+8 54 56.19 ^s -1010.99
March 23			March 25		
0	9 27 12.953 ^s 145.229	+20 23 28.19 ^s -716.50	0	11 19 58.462 ^s 137.074	+8 38 05.20 ^s -1014.69
1	9 29 38.182 ^s 145.045	20 11 31.69 ^s 724.89	1	11 22 15.536 ^s 136.960	8 21 10.51 ^s 1018.29
2	9 32 03.227 ^s 144.858	19 59 26.80 ^s 733.20	2	11 24 32.496 ^s 136.850	8 04 12.22 ^s 1021.76
3	9 34 28.085 ^s 144.671	19 47 13.60 ^s 741.45	3	11 26 49.346 ^s 136.745	7 47 10.46 ^s 1025.11
4	9 36 52.756 ^s 144.483	19 34 52.15 ^s 749.60	4	11 29 06.091 ^s 136.641	7 30 05.35 ^s 1028.34
5	9 39 17.239 ^s 144.293	19 22 22.55 ^s 757.68	5	11 31 22.732 ^s 136.543	7 12 57.01 ^s 1031.45
6	9 41 41.532 ^s 144.104	19 09 44.87 ^s 765.69	6	11 33 39.275 ^s 136.448	6 55 45.56 ^s 1034.44
7	9 44 05.636 ^s 143.914	18 56 59.18 ^s 773.60	7	11 35 55.723 ^s 136.358	6 38 31.12 ^s 1037.31
8	9 46 29.550 ^s 143.723	18 44 05.58 ^s 781.43	8	11 38 12.081 ^s 136.270	6 21 13.81 ^s 1040.06
9	9 48 53.273 ^s 143.532	18 31 04.15 ^s 789.18	9	11 40 28.351 ^s 136.187	6 03 53.75 ^s 1042.69
10	9 51 16.805 ^s 143.340	18 17 54.97 ^s 796.84	10	11 42 44.538 ^s 136.108	5 46 31.06 ^s 1045.20
11	9 53 40.145 ^s 143.149	18 04 38.13 ^s 804.42	11	11 45 00.646 ^s 136.034	5 29 05.86 ^s 1047.57
12	9 56 03.294 ^s 142.958	17 51 13.71 ^s 811.91	12	11 47 16.680 ^s 135.962	5 11 38.29 ^s 1049.84
13	9 58 26.252 ^s 142.767	17 37 41.80 ^s 819.31	13	11 49 32.642 ^s 135.896	4 54 08.45 ^s 1051.97
14	10 00 49.019 ^s 142.576	17 24 02.49 ^s 826.62	14	11 51 48.538 ^s 135.833	4 36 36.48 ^s 1053.98
15	10 03 11.595 ^s 142.386	17 10 15.87 ^s 833.83	15	11 54 04.371 ^s 135.775	4 19 02.50 ^s 1055.88
16	10 05 33.981 ^s 142.196	16 56 22.04 ^s 840.96	16	11 56 20.146 ^s 135.721	4 01 26.62 ^s 1057.64
17	10 07 56.177 ^s 142.007	16 42 21.08 ^s 847.99	17	11 58 35.867 ^s 135.671	3 43 48.98 ^s 1059.28
18	10 10 18.184 ^s 141.819	16 28 13.09 ^s 854.93	18	12 00 51.538 ^s 135.626	3 26 09.70 ^s 1060.80
19	10 12 40.003 ^s 141.632	16 13 58.16 ^s 861.77	19	12 03 07.164 ^s 135.584	3 08 28.90 ^s 1062.19
20	10 15 01.635 ^s 141.445	15 59 36.39 ^s 868.51	20	12 05 22.748 ^s 135.548	2 50 46.71 ^s 1063.45
21	10 17 23.080 ^s 141.261	15 45 07.88 ^s 875.16	21	12 07 38.296 ^s 135.514	2 33 03.26 ^s 1064.60
22	10 19 44.341 ^s 141.077	15 30 32.72 ^s 881.72	22	12 09 53.810 ^s 135.487	2 15 18.66 ^s 1065.61
23	10 22 05.418 ^s 140.894	15 15 51.00 ^s -888.16	23	12 12 09.297 ^s 135.463	1 57 33.05 ^s 1066.51
24	10 24 26.312 ^s	+15 01 02.84 ^s	24	12 14 24.760 ^s	+1 39 46.54 ^s

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
March 26			March 28		
h	h m s	° ' "	h	h m s	° ' "
0	12 14 24.760 ^s	+ 1 39 46.54 ["]	0	14 03 43.731 ^s	-12 09 56.90 ["]
1	12 16 40.203 ^s	1 21 59.27 ["]	1	14 06 03.198 ^s	12 25 54.49 ["]
2	12 18 55.631 ^s	1 04 11.36 ["]	2	14 08 22.837 ^s	12 41 46.86 ["]
3	12 21 11.049 ^s	0 46 22.94 ["]	3	14 10 42.651 ^s	12 57 33.89 ["]
4	12 23 26.461 ^s	0 28 34.13 ["]	4	14 13 02.643 ^s	13 13 15.48 ["]
5	12 25 41.870 ^s	+ 0 10 45.06 ["]	5	14 15 22.814 ^s	13 28 51.52 ["]
6	12 27 57.283 ^s	- 0 07 04.15 ["]	6	14 17 43.168 ^s	13 44 21.90 ["]
7	12 30 12.702 ^s	0 24 53.37 ["]	7	14 20 03.706 ^s	13 59 46.50 ["]
8	12 32 28.133 ^s	0 42 42.47 ["]	8	14 22 24.431 ^s	14 15 05.22 ["]
9	12 34 43.580 ^s	1 00 31.33 ["]	9	14 24 45.344 ^s	14 30 17.96 ["]
10	12 36 59.047 ^s	1 18 19.82 ["]	10	14 27 06.447 ^s	14 45 24.60 ["]
11	12 39 14.539 ^s	1 36 07.81 ["]	11	14 29 27.743 ^s	15 00 25.04 ["]
12	12 41 30.061 ^s	1 53 55.18 ["]	12	14 31 49.233 ^s	15 15 19.18 ["]
13	12 43 45.616 ^s	2 11 41.81 ["]	13	14 34 10.917 ^s	15 30 06.92 ["]
14	12 46 01.209 ^s	2 29 27.56 ["]	14	14 36 32.799 ^s	15 44 48.14 ["]
15	12 48 16.845 ^s	2 47 12.31 ["]	15	14 38 54.879 ^s	15 59 22.75 ["]
16	12 50 32.527 ^s	3 04 55.94 ["]	16	14 41 17.159 ^s	16 13 50.65 ["]
17	12 52 48.261 ^s	3 22 38.31 ["]	17	14 43 39.640 ^s	16 28 11.74 ["]
18	12 55 04.050 ^s	3 40 19.31 ["]	18	14 46 02.322 ^s	16 42 25.91 ["]
19	12 57 19.899 ^s	3 57 58.81 ["]	19	14 48 25.206 ^s	16 56 33.08 ["]
20	12 59 35.812 ^s	4 15 36.68 ["]	20	14 50 48.294 ^s	17 10 33.14 ["]
21	13 01 51.793 ^s	4 33 12.80 ["]	21	14 53 11.586 ^s	17 24 25.99 ["]
22	13 04 07.847 ^s	4 50 47.04 ["]	22	14 55 35.083 ^s	17 38 11.55 ["]
23	13 06 23.978 ^s	- 5 08 19.29 ["]	23	14 57 58.784 ^s	-17 51 49.71 ["]
	136.212	-1050.11		143.907	-810.68
March 27			March 29		
0	13 08 40.190 ^s	- 5 25 49.40 ["]	0	15 00 22.691 ^s	-18 05 20.39 ["]
1	13 10 56.487 ^s	5 43 17.27 ["]	1	15 02 46.802 ^s	18 18 43.49 ["]
2	13 13 12.873 ^s	6 00 42.76 ["]	2	15 05 11.119 ^s	18 31 58.93 ["]
3	13 15 29.353 ^s	6 18 05.75 ["]	3	15 07 35.642 ^s	18 45 06.61 ["]
4	13 17 45.930 ^s	6 35 26.13 ["]	4	15 10 00.369 ^s	18 58 06.44 ["]
5	13 20 02.609 ^s	6 52 43.76 ["]	5	15 12 25.300 ^s	19 10 58.34 ["]
6	13 22 19.393 ^s	7 09 58.52 ["]	6	15 14 50.436 ^s	19 23 42.21 ["]
7	13 24 36.286 ^s	7 27 10.30 ["]	7	15 17 15.774 ^s	19 36 17.99 ["]
8	13 26 53.293 ^s	7 44 18.97 ["]	8	15 19 41.315 ^s	19 48 45.58 ["]
9	13 29 10.416 ^s	8 01 24.40 ["]	9	15 22 07.058 ^s	20 01 04.89 ["]
10	13 31 27.661 ^s	8 18 26.48 ["]	10	15 24 33.000 ^s	20 13 15.86 ["]
11	13 33 45.029 ^s	8 35 25.09 ["]	11	15 26 59.142 ^s	20 25 18.40 ["]
12	13 36 02.526 ^s	8 52 20.11 ["]	12	15 29 25.482 ^s	20 37 12.42 ["]
13	13 38 20.155 ^s	9 09 11.41 ["]	13	15 31 52.017 ^s	20 48 57.86 ["]
14	13 40 37.919 ^s	9 25 58.88 ["]	14	15 34 18.747 ^s	21 00 34.63 ["]
15	13 42 55.821 ^s	9 42 42.40 ["]	15	15 36 45.670 ^s	21 12 02.67 ["]
16	13 45 13.866 ^s	9 59 21.84 ["]	16	15 39 12.783 ^s	21 23 21.89 ["]
17	13 47 32.056 ^s	10 15 57.10 ["]	17	15 41 40.084 ^s	21 34 32.24 ["]
18	13 49 50.395 ^s	10 32 28.06 ["]	18	15 44 07.572 ^s	21 45 33.63 ["]
19	13 52 08.887 ^s	10 48 54.59 ["]	19	15 46 35.243 ^s	21 56 25.99 ["]
20	13 54 27.533 ^s	11 05 16.59 ["]	20	15 49 03.096 ^s	22 07 09.27 ["]
21	13 56 46.338 ^s	11 21 33.93 ["]	21	15 51 31.127 ^s	22 17 43.39 ["]
22	13 59 05.304 ^s	11 37 46.51 ["]	22	15 53 59.334 ^s	22 28 08.29 ["]
23	14 01 24.434 ^s	11 53 54.20 ["]	23	15 56 27.713 ^s	22 38 23.91 ["]
24	14 03 43.731 ^s	-12 09 56.90 ["]	24	15 58 56.262 ^s	-22 48 30.18 ["]
	139.297	-962.70		148.549	-606.27

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
March 30									April 1								
h	m	s	°	'	"	h	m	s	h	m	s	°	'	"	h	m	s
0	15	58	56.262	148.715	-22	48	30.18	-596.86	0	17	59	32.058	150.473	-27	37	02.92	-107.44
1	16	01	24.977	148.878	22	58	27.04	587.41	1	18	02	02.531	150.349	27	38	50.36	97.16
2	16	03	53.855	149.036	23	08	14.45	577.88	2	18	04	32.880	150.217	27	40	27.52	86.90
3	16	06	22.891	149.192	23	17	52.33	568.30	3	18	07	03.097	150.078	27	41	54.42	76.68
4	16	08	52.083	149.344	23	27	20.63	558.67	4	18	09	33.175	149.933	27	43	11.10	66.4
5	16	11	21.427	149.491	23	36	39.30	548.99	5	18	12	03.108	149.780	27	44	17.57	56.30
6	16	13	50.918	149.635	23	45	48.29	539.26	6	18	14	32.888	149.622	27	45	13.87	46.17
7	16	16	20.553	149.773	23	54	47.55	529.47	7	18	17	02.510	149.455	27	46	00.04	36.05
8	16	18	50.326	149.908	24	03	37.02	519.65	8	18	19	31.965	149.282	27	46	36.09	25.98
9	16	21	20.234	150.039	24	12	16.67	509.76	9	18	22	01.247	149.103	27	47	02.07	15.95
10	16	23	50.273	150.163	24	20	46.43	499.85	10	18	24	30.350	148.917	27	47	18.02	5.93
11	16	26	20.436	150.285	24	29	06.28	489.89	11	18	26	59.267	148.724	27	47	23.95	+4.02
12	16	28	50.721	150.400	24	37	16.17	479.88	12	18	29	27.991	148.526	27	47	19.93	13.95
13	16	31	21.121	150.510	24	45	16.05	469.84	13	18	31	56.517	148.319	27	47	05.98	23.84
14	16	33	51.631	150.616	24	53	05.89	459.77	14	18	34	24.836	148.109	27	46	42.14	33.68
15	16	36	22.247	150.716	25	00	45.66	449.65	15	18	36	52.945	147.890	27	46	08.46	43.48
16	16	38	52.963	150.811	25	08	15.31	439.50	16	18	39	20.835	147.666	27	45	24.98	53.24
17	16	41	23.774	150.900	25	15	34.81	429.32	17	18	41	48.501	147.437	27	44	31.74	62.94
18	16	43	54.674	150.984	25	22	44.13	419.10	18	18	44	15.938	147.200	27	43	28.80	72.61
19	16	46	25.658	151.061	25	29	43.23	408.87	19	18	46	43.138	146.959	27	42	16.19	82.23
20	16	48	56.719	151.133	25	36	32.10	398.61	20	18	49	10.097	146.711	27	40	53.96	91.79
21	16	51	27.852	151.199	25	43	10.71	388.31	21	18	51	36.808	146.457	27	39	22.17	101.31
22	16	53	59.051	151.259	25	49	39.02	378.00	22	18	54	03.265	146.200	27	37	40.86	110.78
23	16	56	30.310	151.313	-25	55	57.02	-367.66	23	18	56	29.465	145.935	-27	35	50.08	+120.19
March 31									April 2								
0	16	59	01.623	151.361	-26	02	04.68	-357.30	0	18	58	55.400	145.665	-27	33	49.89	+129.55
1	17	01	32.984	151.401	26	08	01.98	346.93	1	19	01	21.065	145.391	27	31	40.34	138.85
2	17	04	04.385	151.437	26	13	48.91	336.54	2	19	03	46.456	145.111	27	29	21.49	148.11
3	17	06	35.822	151.465	26	19	25.45	326.14	3	19	06	11.567	144.826	27	26	53.38	157.31
4	17	09	07.287	151.486	26	24	51.59	315.72	4	19	08	36.393	144.537	27	24	16.07	166.44
5	17	11	38.773	151.502	26	30	07.31	305.29	5	19	11	00.930	144.243	27	21	29.63	175.53
6	17	14	10.275	151.510	26	35	12.60	294.86	6	19	13	25.173	143.944	27	18	34.10	184.54
7	17	16	41.785	151.512	26	40	07.46	284.41	7	19	15	49.117	143.641	27	15	29.56	193.52
8	17	19	13.297	151.507	26	44	51.87	273.96	8	19	18	12.758	143.333	27	12	16.04	202.41
9	17	21	44.804	151.495	26	49	25.83	263.51	9	19	20	36.091	143.021	27	08	53.63	211.26
10	17	24	16.299	151.476	26	53	49.34	253.05	10	19	22	59.112	142.706	27	05	22.37	220.04
11	17	26	47.775	151.451	26	58	02.39	242.60	11	19	25	21.818	142.385	27	01	42.33	228.76
12	17	29	19.226	151.417	27	02	04.99	232.15	12	19	27	44.203	142.062	26	57	53.57	237.42
13	17	31	50.643	151.378	27	05	57.14	221.69	13	19	30	06.265	141.735	26	53	56.15	246.01
14	17	34	22.021	151.331	27	09	38.83	211.25	14	19	32	28.000	141.403	26	49	50.14	254.53
15	17	36	53.352	151.278	27	13	10.08	200.81	15	19	34	49.403	141.070	26	45	35.61	263.01
16	17	39	24.630	151.216	27	16	30.89	190.37	16	19	37	10.473	140.732	26	41	12.60	271.40
17	17	41	55.846	151.148	27	19	41.26	179.96	17	19	39	31.205	140.391	26	36	41.20	279.74
18	17	44	26.994	151.073	27	22	41.22	169.55	18	19	41	51.596	140.047	26	32	01.46	288.01
19	17	46	58.067	150.991	27	25	30.77	159.15	19	19	44	11.643	139.701	26	27	13.45	296.21
20	17	49	29.058	150.902	27	28	09.92	148.78	20	19	46	31.344	139.351	26	22	17.24	304.34
21	17	51	59.960	150.805	27	30	38.70	138.41	21	19	48	50.695	139.000	26	17	12.90	312.41
22	17	54	30.765	150.702	27	32	57.11	128.07	22	19	51	09.695	138.645	26	12	00.49	320.41
23	17	57	01.467	150.591	27	35	05.18	117.74	23	19	53	28.340	138.289	26	06	40.08	+328.35
24	17	59	32.058		-27	37	02.92		24	19	55	46.629		-26	01	11.73	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
April 3			April 5		
h	h m s	° ' " "	h	h m s	° ' " "
0	19 55 46.629	-26 01 11.73	0	21 39 09.917	-19 25 41.34
1	19 58 04.558	25 55 35.52	1	21 41 10.347	19 15 08.84
2	20 00 22.126	25 49 51.52	2	21 43 10.448	19 04 31.81
3	20 02 39.332	25 43 59.79	3	21 45 10.221	18 53 50.30
4	20 04 56.172	25 38 00.40	4	21 47 09.670	18 43 04.37
5	20 07 12.646	25 31 53.43	5	21 49 08.796	18 32 14.09
6	20 09 28.753	25 25 38.93	6	21 51 07.604	18 21 19.51
7	20 11 44.489	25 19 16.98	7	21 53 06.095	18 10 20.70
8	20 13 59.855	25 12 47.66	8	21 55 04.272	17 59 17.71
9	20 16 14.850	25 06 11.03	9	21 57 02.139	17 48 10.61
10	20 18 29.471	24 59 27.15	10	21 58 59.699	17 36 59.46
11	20 20 43.718	24 52 36.11	11	22 00 56.954	17 25 44.31
12	20 22 57.591	24 45 37.96	12	22 02 53.908	17 14 25.23
13	20 25 11.088	24 38 32.79	13	22 04 50.563	17 03 02.27
14	20 27 24.210	24 31 20.65	14	22 06 46.924	16 51 35.49
15	20 29 36.956	24 24 01.63	15	22 08 42.992	16 40 04.95
16	20 31 49.324	24 16 35.79	16	22 10 38.772	16 28 30.71
17	20 34 01.316	24 09 03.19	17	22 12 34.266	16 16 52.82
18	20 36 12.932	24 01 23.92	18	22 14 29.478	16 05 11.34
19	20 38 24.170	23 53 38.04	19	22 16 24.411	15 53 26.33
20	20 40 35.032	23 45 45.62	20	22 18 19.069	15 41 37.85
21	20 42 45.517	23 37 46.73	21	22 20 13.454	15 29 45.94
22	20 44 55.626	23 29 41.44	22	22 22 07.571	15 17 50.67
23	20 47 05.360	-23 21 29.82	23	22 24 01.422	-15 05 52.09
	129.734	+497.88		113.851	+721.84
	129.358			113.590	
April 4			April 6		
h	h m s	° ' " "	h	h m s	° ' " "
0	20 49 14.718	-23 13 11.94	0	22 25 55.012	-14 53 50.25
1	20 51 23.703	23 04 47.87	1	22 27 48.343	14 41 45.22
2	20 53 32.313	22 56 17.68	2	22 29 41.419	14 29 37.03
3	20 55 40.551	22 47 41.43	3	22 31 34.244	14 17 25.76
4	20 57 48.417	22 38 59.19	4	22 33 26.821	14 05 11.45
5	20 59 55.912	22 30 11.04	5	22 35 19.154	13 52 54.15
6	21 02 03.038	22 21 17.05	6	22 37 11.246	13 40 33.93
7	21 04 09.796	22 12 17.27	7	22 39 03.102	13 28 10.82
8	21 06 16.186	22 03 11.78	8	22 40 54.724	13 15 44.89
9	21 08 22.211	21 54 00.64	9	22 42 46.116	13 03 16.18
10	21 10 27.872	21 44 43.93	10	22 44 37.282	12 50 44.75
11	21 12 33.170	21 35 21.71	11	22 46 28.225	12 38 10.65
12	21 14 38.107	21 25 54.04	12	22 48 18.950	12 25 33.93
13	21 16 42.686	21 16 20.99	13	22 50 09.460	12 12 54.65
14	21 18 46.907	21 06 42.64	14	22 51 59.759	12 00 12.84
15	21 20 50.772	20 56 59.04	15	22 53 49.850	11 47 28.57
16	21 22 54.284	20 47 10.26	16	22 55 39.737	11 34 41.88
17	21 24 57.445	20 37 16.36	17	22 57 29.424	11 21 52.83
18	21 27 00.256	20 27 17.42	18	22 59 18.915	11 09 01.46
19	21 29 02.721	20 17 13.49	19	23 01 08.213	10 56 07.82
20	21 31 04.840	20 07 04.65	20	23 02 57.322	10 43 11.96
21	21 33 06.617	19 56 50.94	21	23 04 46.247	10 30 13.94
22	21 35 08.054	19 46 32.45	22	23 06 34.990	10 17 13.79
23	21 37 09.153	19 36 09.22	23	23 08 23.556	10 04 11.57
24	21 39 09.917	-19 25 41.34	24	23 10 11.949	-9 51 07.33
	120.764	+627.88		108.393	+784.24

MOON, 1967
FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
April 7							April 9						
h	m	s	°	'	"		h	m	s	°	'	"	
0	23	10	11.949	108.223	-	9 51 07.33	0	0 34 46.432	104.626	+	1 00 47.21	827.18	
1	23	12	00.172	108.056		9 38 01.12	1	0 36 31.058	104.646		1 14 34.39	826.94	
2	23	13	48.228	107.895		9 24 52.98	2	0 38 15.704	104.670		1 28 21.33	826.66	
3	23	15	36.123	107.737		9 11 42.96	3	0 40 00.374	104.697		1 42 07.99	826.34	
4	23	17	23.860	107.582		8 58 31.11	4	0 41 45.071	104.729		1 55 54.33	825.97	
5	23	19	11.442	107.432		8 45 17.47	5	0 43 29.800	104.764		2 09 40.30	825.55	
6	23	20	58.874	107.285		8 32 02.10	6	0 45 14.564	104.802		2 23 25.85	825.09	
7	23	22	46.159	107.143		8 18 45.04	7	0 46 59.366	104.845		2 37 10.94	824.59	
8	23	24	33.302	107.003		8 05 26.33	8	0 48 44.211	104.892		2 50 55.53	824.05	
9	23	26	20.305	106.869		7 52 06.03	9	0 50 29.103	104.942		3 04 39.58	823.45	
10	23	28	07.174	106.737		7 38 44.18	10	0 52 14.045	104.996		3 18 23.03	822.81	
11	23	29	53.911	106.610		7 25 20.82	11	0 53 59.041	105.055		3 32 05.84	822.13	
12	23	31	40.521	106.486		7 11 56.01	12	0 55 44.096	105.115		3 45 47.97	821.41	
13	23	33	27.007	106.367		6 58 29.79	13	0 57 29.211	105.181		3 59 29.38	820.63	
14	23	35	13.374	106.251		6 45 02.20	14	0 59 14.392	105.251		4 13 10.01	819.82	
15	23	36	59.625	106.140		6 31 33.29	15	1 00 59.643	105.323		4 26 49.83	818.95	
16	23	38	45.765	106.031		6 18 03.11	16	1 02 44.966	105.401		4 40 28.78	818.04	
17	23	40	31.796	105.928		6 04 31.70	17	1 04 30.367	105.481		4 54 06.82	817.09	
18	23	42	17.724	105.827		5 50 59.11	18	1 06 15.848	105.565		5 07 43.91	816.09	
19	23	44	03.551	105.731		5 37 25.37	19	1 08 01.413	105.653		5 21 20.00	815.04	
20	23	45	49.282	105.639		5 23 50.55	20	1 09 47.066	105.745		5 34 55.04	813.96	
21	23	47	34.921	105.550		5 10 14.68	21	1 11 32.811	105.841		5 48 29.00	812.81	
22	23	49	20.471	105.465		4 56 37.81	22	1 13 18.652	105.939	+	6 02 01.81	811.63	
23	23	51	05.936	105.385	-	4 42 59.98	23	1 15 04.591	106.043	+	6 15 33.44	810.41	
April 8							April 10						
0	23	52	51.321	105.308	-	4 29 21.23	0	1 16 50.634	106.150	+	6 29 03.85	809.12	
1	23	54	36.629	105.236		4 15 41.62	1	1 18 36.784	106.259		6 42 32.97	807.80	
2	23	56	21.865	105.166		4 02 01.18	2	1 20 23.043	106.374		6 56 00.77	806.44	
3	23	58	07.031	105.101		3 48 19.97	3	1 22 09.417	106.492		7 09 27.21	805.01	
4	23	59	52.132	105.039		3 34 38.02	4	1 23 55.909	106.613		7 22 52.22	803.56	
5	0 01	37.171	104.983		3 20 55.38	823.29	5	1 25 42.522	106.739		7 36 15.78	802.04	
6	0 03	22.154	104.928		3 07 12.09	823.89	6	1 27 29.261	106.867		7 49 37.82	800.48	
7	0 05	07.082	104.879		2 53 28.20	824.44	7	1 29 16.128	106.999		8 02 58.30	798.88	
8	0 06	51.961	104.834		2 39 43.76	824.96	8	1 31 03.127	107.136		8 16 17.18	797.22	
9	0 08	36.795	104.791		2 25 58.80	825.43	9	1 32 50.263	107.275		8 29 34.40	795.52	
10	0 10	21.586	104.754		2 12 13.37	825.86	10	1 34 37.538	107.419		8 42 49.92	793.77	
11	0 12	06.340	104.719		1 58 27.51	826.23	11	1 36 24.957	107.566		8 56 03.69	791.97	
12	0 13	51.059	104.689		1 44 41.28	826.57	12	1 38 12.523	107.716		9 09 15.66	790.12	
13	0 15	35.748	104.662		1 30 54.71	826.87	13	1 40 00.239	107.870		9 22 25.78	788.23	
14	0 17	20.410	104.640		1 17 07.84	827.11	14	1 41 48.109	108.029		9 35 34.01	786.29	
15	0 19	05.050	104.622		1 03 20.73	827.32	15	1 43 36.138	108.189		9 48 40.30	784.29	
16	0 20	49.672	104.606		0 49 33.41	827.47	16	1 45 24.327	108.354		10 01 44.59	782.24	
17	0 22	34.278	104.595		0 35 45.94	827.60	17	1 47 12.681	108.523		10 14 46.83	780.16	
18	0 24	18.873	104.589		0 21 58.34	827.67	18	1 49 01.204	108.694		10 27 46.99	778.01	
19	0 26	03.462	104.585		-	0 08 10.67	19	1 50 49.898	108.870		10 40 45.00	775.81	
20	0 27	48.047	104.586		+	0 05 37.02	20	1 52 38.768	109.049		10 53 40.81	773.58	
21	0 29	32.633	104.590			0 19 24.70	21	1 54 27.817	109.231		11 06 34.39	771.28	
22	0 31	17.223	104.598			0 33 12.32	22	1 56 17.048	109.417		11 19 25.67	768.94	
23	0 33	01.821	104.611			0 46 59.84	23	1 58 06.465	109.607	+	11 32 14.61	766.55	
24	0 34	46.432			+	1 00 47.21	24	1 59 56.072		+	11 45 01.16		

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
April 11							April 13						
h	m	s		°	'	"	h	m	s		°	'	"
0	1 59	56.072	109.798	+11	45	01.16	0	3 32	21.013	122.528	+20	53	43.90
1	2 01	45.870	109.995	11	57	45.26	1	3 34	23.541	122.849	21	03	25.90
2	2 03	35.865	110.195	12	10	26.86	2	3 36	26.390	123.171	21	13	02.66
3	2 05	26.060	110.397	12	23	05.92	3	3 38	29.561	123.494	21	22	34.12
4	2 07	16.457	110.604	12	35	42.37	4	3 40	33.055	123.819	21	32	00.21
5	2 09	07.061	110.813	12	48	16.17	5	3 42	36.874	124.145	21	41	20.89
6	2 10	57.874	111.026	13	00	47.27	6	3 44	41.019	124.472	21	50	36.07
7	2 12	48.900	111.243	13	13	15.62	7	3 46	45.491	124.799	21	59	45.71
8	2 14	40.143	111.461	13	25	41.15	8	3 48	50.290	125.127	22	08	49.73
9	2 16	31.604	111.684	13	38	03.82	9	3 50	55.417	125.457	22	17	48.08
10	2 18	23.288	111.910	13	50	23.57	10	3 53	00.874	125.787	22	26	40.70
11	2 20	15.198	112.140	14	02	40.36	11	3 55	06.661	126.118	22	35	27.51
12	2 22	07.338	112.371	14	14	54.13	12	3 57	12.779	126.448	22	44	08.45
13	2 23	59.709	112.606	14	27	04.81	13	3 59	19.227	126.781	22	52	43.47
14	2 25	52.315	112.845	14	39	12.37	14	4 01	26.008	127.111	23	01	12.50
15	2 27	45.160	113.087	14	51	16.74	15	4 03	33.119	127.445	23	09	35.48
16	2 29	38.247	113.331	15	03	17.88	16	4 05	40.564	127.776	23	17	52.34
17	2 31	31.578	113.578	15	15	15.71	17	4 07	48.340	128.108	23	26	03.01
18	2 33	25.156	113.829	15	27	10.20	18	4 09	56.448	128.441	23	34	07.45
19	2 35	18.985	114.083	15	39	01.29	19	4 12	04.889	128.773	23	42	05.58
20	2 37	13.068	114.339	15	50	48.91	20	4 14	13.662	129.105	23	49	57.34
21	2 39	07.407	114.598	16	02	33.02	21	4 16	22.767	129.437	23	57	42.67
22	2 41	02.005	114.861	16	14	13.55	22	4 18	32.204	129.767	24	05	21.51
23	2 42	56.866	115.126	+16	25	50.46	23	4 20	41.971	130.099	+24	12	53.78
April 12							April 14						
0	2 44	51.992	115.393	+16	37	23.68	0	4 22	52.070	130.428	+24	20	19.44
1	2 46	47.385	115.663	16	48	53.16	1	4 25	02.498	130.757	24	27	38.42
2	2 48	43.048	115.937	17	00	18.83	2	4 27	13.255	131.086	24	34	50.64
3	2 50</												

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
April 15			April 17		
h	h m s	° ' "	h	h m s	° ' "
0	5 16 30.353 ^s	+26° 42' 49.35"	0	7 10 44.899 ^s	+27° 25' 00.30"
1	5 18 48.229	137.876	1	7 13 10.753	145.854
2	5 21 06.384	138.155	2	7 15 36.634	145.881
3	5 23 24.815	138.431	3	7 18 02.537	145.903
4	5 25 43.517	138.702	4	7 20 28.457	145.920
5	5 28 02.487	138.970	5	7 22 54.386	145.929
6	5 30 21.721	139.234	6	7 25 20.320	145.934
7	5 32 41.216	139.495	7	7 27 46.252	145.932
8	5 35 00.967	139.751	8	7 30 12.178	145.926
9	5 37 20.971	140.004	9	7 32 38.091	145.913
10	5 39 41.222	140.251	10	7 35 03.986	145.895
11	5 42 01.717	140.495	11	7 37 29.857	145.871
12	5 44 22.451	140.734	12	7 39 55.699	145.842
13	5 46 43.420	140.969	13	7 42 21.506	145.807
14	5 49 04.619	141.199	14	7 44 47.274	145.768
15	5 51 26.044	141.425	15	7 47 12.997	145.723
16	5 53 47.690	141.646	16	7 49 38.669	145.672
17	5 56 09.552	141.862	17	7 52 04.286	145.617
18	5 58 31.625	142.073	18	7 54 29.843	145.557
19	6 00 53.903	142.278	19	7 56 55.335	145.492
20	6 03 16.383	142.480	20	7 59 20.757	145.422
21	6 05 39.059	142.676	21	8 01 46.104	145.347
22	6 08 01.925	142.866	22	8 04 11.372	145.268
23	6 10 24.976	143.051	23	8 06 36.556	145.184
	143.232	+27 46 46.03		145.096	+25 36 37.70
		+60.55			-397.50
April 16			April 18		
h	h m s	° ' "	h	h m s	° ' "
0	6 12 48.208	143.405	0	8 09 01.652	145.002
1	6 15 11.613	143.575	1	8 11 26.654	144.906
2	6 17 35.188	143.738	2	8 13 51.560	144.805
3	6 19 58.926	143.896	3	8 16 16.365	144.700
4	6 22 22.822	144.048	4	8 18 41.065	144.590
5	6 24 46.870	144.194	5	8 21 05.655	144.478
6	6 27 11.064	144.335	6	8 23 30.133	144.361
7	6 29 35.399	144.470	7	8 25 54.494	144.240
8	6 31 59.869	144.599	8	8 28 18.734	144.117
9	6 34 24.468	144.723	9	8 30 42.851	143.990
10	6 36 49.191	144.839	10	8 33 06.841	143.860
11	6 39 14.030	144.951	11	8 35 30.701	143.726
12	6 41 38.981	145.056	12	8 37 54.427	143.589
13	6 44 04.037	145.156	13	8 40 18.016	143.451
14	6 46 29.193	145.249	14	8 42 41.467	143.307
15	6 48 54.442	145.336	15	8 45 04.774	143.164
16	6 51 19.778	145.418	16	8 47 27.938	143.015
17	6 53 45.196	145.494	17	8 49 50.953	142.866
18	6 56 10.690	145.563	18	8 52 13.819	142.714
19	6 58 36.253	145.626	19	8 54 36.533	142.560
20	7 01 01.879	145.684	20	8 56 59.093	142.403
21	7 03 27.563	145.735	21	8 59 21.496	142.246
22	7 05 53.298	145.781	22	9 01 43.742	142.085
23	7 08 19.079	145.820	23	9 04 05.827	141.924
24	7 10 44.899	145.820	24	9 06 27.751	141.751
		+27 25 00.30			+22 05 14.77

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
April 19							April 21						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	9	06	27.751	141.761	+22	05 14.77	0	10	56	47.481	134.414	+11	28 53.04
1	9	08	49.512	141.596	21	54 52.87	1	10	59	01.895	134.312	11	13 06.04
2	9	11	11.108	141.430	21	44 22.59	2	11	01	16.207	134.214	10	57 14.26
3	9	13	32.538	141.264	21	33 43.98	3	11	03	30.421	134.119	10	41 17.80
4	9	15	53.802	141.095	21	22 57.10	4	11	05	44.540	134.029	10	25 16.75
5	9	18	14.897	140.926	21	12 02.00	5	11	07	58.569	133.942	10	09 11.20
6	9	20	35.823	140.757	21	00 58.74	6	11	10	12.511	133.859	9	53 01.26
7	9	22	56.580	140.587	20	49 47.38	7	11	12	26.370	133.778	9	36 47.01
8	9	25	17.167	140.415	20	38 27.98	8	11	14	40.148	133.704	9	20 28.57
9	9	27	37.582	140.244	20	27 00.60	9	11	16	53.852	133.631	9	04 06.01
10	9	29	57.826	140.073	20	15 25.30	10	11	19	07.483	133.564	8	47 39.45
11	9	32	17.899	139.901	20	03 42.15	11	11	21	21.047	133.500	8	31 08.98
12	9	34	37.800	139.729	19	51 51.21	12	11	23	34.547	133.439	8	14 34.70
13	9	36	57.529	139.557	19	39 52.54	13	11	25	47.986	133.384	7	57 56.72
14	9	39	17.086	139.385	19	27 46.21	14	11	28	01.370	133.333	7	41 15.13
15	9	41	36.471	139.215	19	15 32.28	15	11	30	14.703	133.285	7	24 30.03
16	9	43	55.686	139.043	19	03 10.82	16	11	32	27.988	133.243	7	07 41.54
17	9	46	14.729	138.873	18	50 41.90	17	11	34	41.231	133.203	6	50 49.74
18	9	48	33.602	138.703	18	38 05.59	18	11	36	54.434	133.169	6	33 54.75
19	9	50	52.305	138.534	18	25 21.96	19	11	39	07.603	133.138	6	16 56.67
20	9	53	10.839	138.366	18	12 31.07	20	11	41	20.741	133.113	5	59 55.61
21	9	55	29.205	138.199	17	59 33.01	21	11	43	33.854	133.091	5	42 51.67
22	9	57	47.404	138.033	17	46 27.83	22	11	45	46.945	133.074	5	25 44.95
23	10	00	05.437	137.868	+17	33 15.62	23	11	48	00.019	133.062	+5	08 35.58
April 20							April 22						
0	10	02	23.305	137.704	+17	19 56.45	0	11	50	13.081	133.053	+4	51 23.64
1	10	04	41.009	137.542	17	06 30.39	1	11	52	26.134	133.051	4	34 09.25
2	10	06	58.551	137.382	16	52 57.52	2	11	54	39.185	133.051	4	16 52.53
3	10	09	15.933	137.222	16	39 17.91	3	11	56	52.236	133.057	3	59 33.57
4	10	11	33.155	137.065	16	25 31.64	4	11	59	05.293	133.067	3	42 12.50
5	10	13	50.220	136.909	16	11 38.79	5	12	01	18.360	133.082	3	24 49.41
6	10	16	07.129	136.755	15	57 39.44	6	12	03	31.442	133.101	3	07 24.43
7	10	18	23.884	136.604	15	43 33.66	7	12	05	44.543	133.126	2	49 57.66
8	10	20	40.488	136.454	15	29 21.54	8	12	07	57.669	133.155	2	32 29.22
9	10	22	56.942	136.307	15	15 03.15	9	12	10	10.824	133.188	2	14 59.22
10	10	25	13.249	136.161	15	00 38.59	10	12	12	24.012	133.226	1	57 27.77
11	10	27	29.410	136.019	14	46 07.92	11	12	14	37.238	133.269	1	39 54.99
12	10	29	45.429	135.878	14	31 31.24	12	12	16	50.507	133.317	1	22 20.99
13	10	32	01.307	135.740	14	16 48.63	13	12	19	03.824	133.369	1	04 45.89
14	10	34	17.047	135.605	14	02 00.17	14	12	21	17.193	133.427	0	47 09.80
15	10	36	32.652	135.473	13	47 05.94	15	12	23	30.620	133.488	0	29 32.85
16	10	38	48.125	135.343	13	32 06.04	16	12	25	44.108	133.555	+0	11 55.14
17	10	41	03.468	135.215	13	17 00.55	17	12	27	57.663	133.626	-0	05 43.20
18	10	43	18.683	135.092	13	01 49.56	18	12	30	11.289	133.702	0	23 22.07
19	10	45	33.775	134.971	12	46 33.15	19	12	32	24.991	133.783	0	41 01.33
20	10	47	48.746	134.852	12	31 11.42	20	12	34	38.774	133.868	0	58 40.87
21	10	50	03.598	134.738	12	15 44.45	21	12	36	52.642	133.959	1	16 20.57
22	10	52	18.336	134.627	12	00 12.34	22	12	39	06.601	134.053	1	34 00.31
23	10	54	32.963	134.518	11	44 35.17	23	12	41	20.654	134.154	1	51 39.97
24	10	56	47.481	134.414	+11	28 53.04	24	12	43	34.808	134.262	-2	09 19.42

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
April 23			April 25		
h	h m s	° ' "	h	h m s	° ' "
0	12 43 34.808	-2 09 19.42	0	14 34 15.261	-15 32 17.83
1	12 45 49.065	2 26 58.56	1	14 36 39.243	15 47 14.49
2	12 48 03.432	2 44 37.26	2	14 39 03.498	16 02 04.71
3	12 50 17.912	3 02 15.38	3	14 41 28.024	16 16 48.38
4	12 52 32.510	3 19 52.82	4	14 43 52.825	16 31 25.38
5	12 54 47.232	3 37 29.45	5	14 46 17.899	16 45 55.59
6	12 57 02.081	3 55 05.14	6	14 48 43.249	17 00 18.90
7	12 59 17.062	4 12 39.78	7	14 51 08.874	17 14 35.18
8	13 01 32.179	4 30 13.24	8	14 53 34.775	17 28 44.33
9	13 03 47.438	4 47 45.38	9	14 56 00.951	17 42 46.23
10	13 06 02.842	5 05 16.10	10	14 58 27.493	17 56 40.77
11	13 08 18.397	5 22 45.27	11	15 00 54.132	18 10 27.83
12	13 10 34.106	5 40 12.75	12	15 03 21.135	18 24 07.31
13	13 12 49.973	5 57 38.43	13	15 05 48.414	18 37 39.10
14	13 15 06.004	6 15 02.18	14	15 08 15.966	18 51 03.08
15	13 17 22.203	6 32 23.86	15	15 10 43.793	19 04 19.14
16	13 19 38.573	6 49 43.37	16	15 13 11.891	19 17 27.20
17	13 21 55.119	7 07 00.57	17	15 15 40.261	19 30 27.12
18	13 24 11.845	7 24 15.33	18	15 18 08.902	19 43 18.82
19	13 26 28.756	7 41 27.53	19	15 20 37.810	19 56 02.19
20	13 28 45.855	7 58 37.04	20	15 23 06.986	20 08 37.13
21	13 31 03.145	8 15 43.74	21	15 25 36.427	20 21 03.53
22	13 33 20.632	8 32 47.49	22	15 28 06.130	20 33 21.30
23	13 35 38.320	-8 49 48.18	23	15 30 36.095	-20 45 30.34
	137.891	-101.749		150.223	-720.22
April 24			April 26		
h	h m s	° ' "	h	h m s	° ' "
0	13 37 56.211	-9 06 45.67	0	15 33 06.318	-20 57 30.56
1	13 40 14.309	9 23 39.83	1	15 35 36.796	21 09 21.85
2	13 42 32.619	9 40 30.55	2	15 38 07.528	21 21 04.14
3	13 44 51.143	9 57 17.69	3	15 40 38.510	21 32 37.31
4	13 47 09.886	10 14 01.12	4	15 43 09.739	21 44 01.30
5	13 49 28.851	10 30 40.72	5	15 45 41.212	21 55 15.99
6	13 51 48.041	10 47 16.37	6	15 48 12.925	22 06 21.32
7	13 54 07.459	11 03 47.93	7	15 50 44.875	22 17 17.19
8	13 56 27.109	11 20 15.28	8	15 53 17.057	22 28 03.53
9	13 58 46.994	11 36 38.29	9	15 55 49.469	22 38 40.24
10	14 01 07.117	11 52 56.84	10	15 58 22.104	22 49 07.25
11	14 03 27.480	12 09 10.80	11	16 00 54.960	22 59 24.48
12	14 05 48.088	12 25 20.04	12	16 03 28.031	23 09 31.85
13	14 08 08.941	12 41 24.44	13	16 06 01.313	23 19 29.30
14	14 10 30.043	12 57 23.88	14	16 08 34.801	23 29 16.74
15	14 12 51.397	13 13 18.23	15	16 11 08.490	23 38 54.11
16	14 15 13.005	13 29 07.36	16	16 13 42.374	23 48 21.34
17	14 17 34.869	13 44 51.15	17	16 16 16.448	23 57 38.35
18	14 19 56.991	14 00 29.47	18	16 18 50.706	24 06 45.10
19	14 22 19.374	14 16 02.21	19	16 21 25.143	24 15 41.51
20	14 24 42.020	14 31 29.24	20	16 23 59.752	24 24 27.52
21	14 27 04.929	14 46 50.44	21	16 26 34.528	24 33 03.08
22	14 29 28.105	15 02 05.69	22	16 29 09.463	24 41 28.12
23	14 31 51.548	15 17 14.86	23	16 31 44.553	24 49 42.60
24	14 34 15.261	-15 32 17.83	24	16 34 19.789	-483.86

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
April 27			April 29		
h	h m s	° ' " "	h	h m s	° ' " "
0	16 34 19.789	155.377	0	18 38 48.287	152.467
1	16 36 55.166	155.510	1	18 41 20.754	152.202
2	16 39 30.676	155.637	2	18 43 52.956	151.930
3	16 42 06.313	155.756	3	18 46 24.886	151.648
4	16 44 42.069	155.867	4	18 48 56.534	151.362
5	16 47 17.936	155.972	5	18 51 27.896	151.068
6	16 49 53.908	156.069	6	18 53 58.964	150.767
7	16 52 29.977	156.158	7	18 56 29.731	150.460
8	16 55 06.135	156.239	8	18 59 00.191	150.146
9	16 57 42.374	156.312	9	19 01 30.337	149.827
10	17 00 18.686	156.378	10	19 04 00.164	149.500
11	17 02 55.064	156.435	11	19 06 29.664	149.168
12	17 05 31.499	156.484	12	19 08 58.832	148.831
13	17 08 07.983	156.524	13	19 11 27.663	148.487
14	17 10 44.507	156.557	14	19 13 56.150	148.139
15	17 13 21.064	156.581	15	19 16 24.289	147.785
16	17 15 57.645	156.596	16	19 18 52.074	147.425
17	17 18 34.241	156.602	17	19 21 19.499	147.062
18	17 21 10.843	156.600	18	19 23 46.561	146.693
19	17 23 47.443	156.589	19	19 26 13.254	146.319
20	17 26 24.032	156.570	20	19 28 39.573	145.942
21	17 29 00.602	156.541	21	19 31 05.515	145.559
22	17 31 37.143	156.504	22	19 33 31.074	145.174
23	17 34 13.647	156.457	23	19 35 56.248	144.784
April 28			April 30		
0	17 36 50.104	156.403	0	19 38 21.032	144.389
1	17 39 26.507	156.338	1	19 40 45.421	143.993
2	17 42 02.845	156.265	2	19 43 09.414	143.592
3	17 44 39.110	156.184	3	19 45 33.006	143.188
4	17 47 15.294	156.093	4	19 47 56.194	142.782
5	17 49 51.387	155.993	5	19 50 18.976	142.372
6	17 52 27.380	155.884	6	19 52 41.348	141.959
7	17 55 03.264	155.767	7	19 55 03.307	141.545
8	17 57 39.031	155.641	8	19 57 24.852	141.128
9	18 00 14.672	155.505	9	19 59 45.980	140.708
10	18 02 50.177	155.362	10	20 02 06.688	140.287
11	18 05 25.539	155.209	11	20 04 26.975	139.864
12	18 08 00.748	155.048	12	20 06 46.839	139.439
13	18 10 35.796	154.878	13	20 09 06.278	139.013
14	18 13 10.674	154.700	14	20 11 25.291	138.585
15	18 15 45.374	154.513	15	20 13 43.876	138.157
16	18 18 19.887	154.318	16	20 16 02.033	137.726
17	18 20 54.205	154.115	17	20 18 19.759	137.296
18	18 23 28.320	153.903	18	20 20 37.055	136.865
19	18 26 02.223	153.683	19	20 22 53.920	136.432
20	18 28 35.906	153.456	20	20 25 10.352	136.000
21	18 31 09.362	153.221	21	20 27 26.352	135.568
22	18 33 42.583	152.977	22	20 29 41.920	135.134
23	18 36 15.560	152.727	23	20 31 57.054	134.702
24	18 38 48.287		24	20 34 11.756	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
May 1			May 3		
h	m	s	h	m	s
0	20 34 11.756	134.269	0	22 13 57.354	115.761
1	20 36 26.025	133.836	1	22 15 53.115	115.450
2	20 38 39.861	133.405	2	22 17 48.569	115.150
3	20 40 53.266	132.973	3	22 19 43.719	114.851
4	20 43 06.239	132.543	4	22 21 38.570	114.555
5	20 45 18.782	132.113	5	22 23 33.125	114.263
6	20 47 30.895	131.683	6	22 25 27.388	113.975
7	20 49 42.578	131.256	7	22 27 21.363	113.692
8	20 51 53.834	130.829	8	22 29 15.055	113.413
9	20 54 04.663	130.403	9	22 31 08.468	113.138
10	20 56 15.066	129.980	10	22 33 01.606	112.866
11	20 58 25.046	129.557	11	22 34 54.472	112.600
12	21 00 34.603	129.135	12	22 36 47.072	112.337
13	21 02 43.738	128.717	13	22 38 39.409	112.078
14	21 04 52.455	128.299	14	22 40 31.487	111.824
15	21 07 00.754	127.884	15	22 42 23.311	111.574
16	21 09 08.638	127.471	16	22 44 14.885	111.328
17	21 11 16.109	127.059	17	22 46 06.213	111.087
18	21 13 23.168	126.649	18	22 47 57.300	110.849
19	21 15 29.817	126.243	19	22 49 48.149	110.616
20	21 17 36.060	125.839	20	22 51 38.765	110.388
21	21 19 41.899	125.437	21	22 53 29.153	110.163
22	21 21 47.336	125.037	22	22 55 19.316	109.943
23	21 23 52.373	124.640	23	22 57 09.259	109.727
May 2			May 4		
0	21 25 57.013	124.247	0	22 58 58.986	109.515
1	21 28 01.260	123.855	1	23 00 48.501	109.308
2	21 30 05.115	123.466	2	23 02 37.809	109.105
3	21 32 08.581	123.081	3	23 04 26.914	108.907
4	21 34 11.662	122.699	4	23 06 15.821	108.712
5	21 36 14.361	122.319	5	23 08 04.533	108.522
6	21 38 16.680	121.943	6	23 09 53.055	108.337
7	21 40 18.623	121.569	7	23 11 41.392	108.155
8	21 42 20.192	121.200	8	23 13 29.547	107.978
9	21 44 21.392	120.833	9	23 15 17.525	107.806
10	21 46 22.225	120.469	10	23 17 05.331	107.637
11	21 48 22.694	120.110	11	23 18 52.968	107.473
12	21 50 22.804	119.753	12	23 20 40.441	107.313
13	21 52 22.557	119.401	13	23 22 27.754	107.158
14	21 54 21.958	119.051	14	23 24 14.912	107.007
15	21 56 21.009	118.705	15	23 26 01.919	106.861
16	21 58 19.714	118.363	16	23 27 48.780	106.718
17	22 00 18.077	118.025	17	23 29 35.498	106.580
18	22 02 16.102	117.690	18	23 31 22.078	106.446
19	22 04 13.792	117.359	19	23 33 08.524	106.317
20	22 06 11.151	117.032	20	23 34 54.841	106.192
21	22 08 08.183	116.708	21	23 36 41.033	106.071
22	22 10 04.891	116.389	22	23 38 27.104	105.954
23	22 12 01.280	116.074	23	23 40 13.058	105.843
24	22 13 57.354	115.761	24	23 41 58.901	105.735

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
May 5							May 7						
h	m	s	°	'	″	″	h	m	s	°	'	″	″
0	23	41	58.901	105.734	-	5 55 12.53	0	1	05	50.649	105.517	+	5 03 29.65
1	23	43	44.635	105.631		5 41 38.70	1	1	07	36.166	105.612		5 17 06.62
2	23	45	30.266	105.531		5 28 03.82	2	1	09	21.778	105.712		5 30 42.62
3	23	47	15.797	105.437		5 14 27.95	3	1	11	07.490	105.817		5 44 17.59
4	23	49	01.234	105.346		5 00 51.11	4	1	12	53.307	105.924		5 57 51.51
5	23	50	46.580	105.260		4 47 13.36	5	1	14	39.231	106.037		6 11 24.31
6	23	52	31.840	105.177		4 33 34.73	6	1	16	25.268	106.152		6 24 55.96
7	23	54	17.017	105.100		4 19 55.27	7	1	18	11.420	106.272		6 38 26.41
8	23	56	02.117	105.026		4 06 15.02	8	1	19	57.692	106.396		6 51 55.61
9	23	57	47.143	104.957		3 52 34.01	9	1	21	44.088	106.523		7 05 23.53
10	23	59	32.100	104.892		3 38 52.30	10	1	23	30.611	106.654		7 18 50.10
11	0	01	16.992	104.831		3 25 09.91	11	1	25	17.265	106.790		7 32 15.29
12	0	03	01.823	104.774		3 11 26.90	12	1	27	04.055	106.930		7 45 39.05
13	0	04	46.597	104.722		2 57 43.31	13	1	28	50.985	107.072		7 59 01.34
14	0	06	31.319	104.674		2 43 59.17	14	1	30	38.057	107.219		8 12 22.09
15	0	08	15.993	104.630		2 30 14.53	15	1	32	25.276	107.369		8 25 41.28
16	0	10	00.623	104.591		2 16 29.43	16	1	34	12.645	107.525		8 38 58.84
17	0	11	45.214	104.555		2 02 43.91	17	1	36	00.170	107.682		8 52 14.74
18	0	13	29.769	104.524		1 48 58.00	18	1	37	47.852	107.844		9 05 28.92
19	0	15	14.293	104.498		1 35 11.76	19	1	39	35.696	108.010		9 18 41.33
20	0	16	58.791	104.474		1 21 25.23	20	1	41	23.706	108.180		9 31 51.93
21	0	18	43.265	104.456		1 07 38.44	21	1	43	11.886	108.353		9 45 00.66
22	0	20	27.721	104.441		0 53 51.43	22	1	45	00.239	108.530		9 58 07.49
23	0	22	12.162	104.432	-	0 40 04.25	23	1	46	48.769	108.710	+	10 11 12.35
May 6							May 8						
0	0	23	56.594	104.425	-	0 26 16.94	0	1	48	37.479	108.895	+	10 24 15.20
1	0	25	41.019	104.423	-	0 12 29.53	1	1	50	26.374	109.082		10 37 15.98
2	0	27	25.442	104.426	+	0 01 17.92	2	1	52	15.456	109.274		10 50 14.65
3	0	29	09.868	104.432		0 15 05.38	3	1	54	04.730	109.470		11 03 11.16
4	0	30	54.300	104.443		0 28 52.81	4	1	55	54.200	109.668		11 16 05.45
5	0	32	38.743	104.458		0 42 40.16	5	1	57	43.868	109.870		11 28 57.48
6	0	34	23.201	104.476		0 56 27.40	6	1	59	33.738	110.076		11 41 47.18
7	0	36	07.677	104.500		1 10 14.47	7	2	01	23.814	110.285		11 54 34.51
8	0	37	52.177	104.527		1 24 01.35	8	2	03	14.099	110.499		12 07 19.42
9	0	39	36.704	104.558		1 37 47.99	9	2	05	04.598	110.714		12 20 01.85
10	0	41	21.262	104.594		1 51 34.34	10	2	06	55.312	110.934		12 32 41.76
11	0	43	05.856	104.633		2 05 20.36	11	2	08	46.246	111.158		12 45 19.07
12	0	44	50.489	104.676		2 19 06.02	12	2	10	37.404	111.384		12 57 53.75
13	0	46	35.165	104.725		2 32 51.27	13	2	12	28.788	111.614		13 10 25.74
14	0	48	19.890	104.776		2 46 36.06	14	2	14	20.402	111.847		13 22 54.98
15	0	50	04.666	104.832		3 00 20.36	15	2	16	12.249	112.084		13 35 21.43
16	0	51	49.498	104.891		3 14 04.12	16	2	18	04.333	112.323		13 47 45.01
17	0	53	34.389	104.956		3 27 47.30	17	2	19	56.656	112.566		14 00 05.68
18	0	55	19.345	105.024		3 41 29.85	18	2	21	49.222	112.813		14 12 23.39
19	0	57	04.369	105.096		3 55 11.74	19	2	23	42.035	113.062		14 24 38.07
20	0	58	49.465	105.172		4 08 52.92	20	2	25	35.097	113.314		14 36 49.68
21	1	00	34.637	105.252		4 22 33.34	21	2	27	28.411	113.570		14 48 58.14
22	1	02	19.889	105.336		4 36 12.97	22	2	29	21.981	113.829		15 01 03.42
23	1	04	05.225	105.424		4 49 51.75	23	2	31	15.810	114.091		15 13 05.44
24	1	05	50.649		+	5 03 29.65	24	2	33	09.901		+	15 25 04.15

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
May 9									May 11								
h	m	s	°	'	°	'	h	m	s	h	m	s	°	'	°	'	
0	2	33	09.901	114.355	+15	25 04.15	0	4	10	20.133	129.450	+23	35 08.27	480.24			
1	2	35	04.256	114.622	15	36 59.50	1	4	12	29.583	129.783	23	43 08.51	473.75			
2	2	36	58.878	114.893	15	48 51.42	2	4	14	39.366	130.116	23	51 02.26	467.18			
3	2	38	53.771	115.167	16	00 39.86	3	4	16	49.482	130.447	23	58 49.44	460.56			
4	2	40	48.938	115.442	16	12 24.76	4	4	18	59.929	130.779	24	06 30.00	453.86			
5	2	42	44.380	115.722	16	24 06.05	5	4	21	10.708	131.108	24	14 03.86	447.11			
6	2	44	40.102	116.003	16	35 43.69	6	4	23	21.816	131.436	24	21 30.97	440.28			
7	2	46	36.105	116.287	16	47 17.60	7	4	25	33.252	131.764	24	28 51.25	433.39			
8	2	48	32.392	116.575	16	58 47.72	8	4	27	45.016	132.088	24	36 04.64	426.44			
9	2	50	28.967	116.863	17	10 14.01	9	4	29	57.104	132.413	24	43 11.08	419.42			
10	2	52	25.830	117.156	17	21 36.39	10	4	32	09.517	132.735	24	50 10.50	412.35			
11	2	54	22.986	117.450	17	32 54.81	11	4	34	22.252	133.056	24	57 02.85	405.20			
12	2	56	20.436	117.747	17	44 09.20	12	4	36	35.308	133.373	25	03 48.05	397.99			
13	2	58	18.183	118.047	17	55 19.51	13	4	38	48.681	133.691	25	10 26.04	390.73			
14	3	00	16.230	118.347	18	06 25.66	14	4	41	02.372	134.004	25	16 56.77	383.40			
15	3	02	14.577	118.652	18	17 27.61	15	4	43	16.376	134.316	25	23 20.17	376.00			
16	3	04	13.229	118.957	18	28 25.27	16	4	45	30.692	134.626	25	29 36.17	368.55			
17	3	06	12.186	119.265	18	39 18.60	17	4	47	45.318	134.932	25	35 44.72	361.04			
18	3	08	11.451	119.576	18	50 07.54	18	4	50	00.250	135.237	25	41 45.76	353.46			
19	3	10	11.027	119.887	19	00 52.00	19	4	52	15.487	135.538	25	47 39.22	345.83			
20	3	12	10.914	120.202	19	11 31.94	20	4	54	31.025	135.836	25	53 25.05	338.14			
21	3	14	11.116	120.517	19	22 07.29	21	4	56	46.861	136.132	25	59 03.19	330.38			
22	3	16	11.633	120.835	19	32 37.98	22	4	59	02.993	136.425	26	04 33.57	322.57			
23	3	18	12.468	121.154	+19	43 03.96	23	5	01	19.418	136.713	+26	09 56.14	+314.71			
May 10									May 12								
0	3	20	13.622	121.475	+19	53 25.15	0	5	03	36.131	136.999	+26	15 10.85	+306.78			
1	3	22	15.097	121.798	20	03 41.49	1	5	05	53.130	137.282	26	20 17.63	298.80			
2	3	24	16.895	122.121	20	13 52.91	2	5	08	10.412	137.560	26	25 16.43	290.77			
3	3	26	19.016	122.447	20	23 59.36	3	5	10	27.972	137.834	26	30 07.20	282.67			
4	3	28	21.463	122.773	20	34 00.77	4	5	12	45.806	138.106	26	34 49.87	274.53			
5	3	30	24.236	123.102	20	43 57.07	5	5	15	03.912	138.373	26	39 24.40	266.33			
6	3	32	27.338	123.430	20	53 48.19	6	5	17	22.285	138.635	26	43 50.73	258.08			
7	3	34	30.768	123.761	21	03 34.07	7	5	19	40.920	138.895	26	48 08.81	249.78			
8	3	36	34.529	124.092	21	13 14.65	8	5	21	59.815	139.149	26	52 18.59	241.43			
9	3	38	38.621	124.424	21	22 49.85	9	5	24	18.964	139.399	26	56 20.02	233.02			
10	3	40	43.045	124.757	21	32 19.62	10	5	26	38.363	139.644	27	00 13.04	224.57			
11	3	42	47.802	125.090	21	41 43.88	11	5	28	58.007	139.886	27	03 57.61	216.07			
12	3	44	52.892	125.425	21	51 02.57	12	5	31	17.893	140.122	27	07 33.68	207.53			
13	3	46	58.317	125.759	22	00 15.63	13	5	33	38.015	140.353	27	11 01.21	198.93			
14	3	49	04.076	126.095	22	09 22.98	14	5	35	58.368	140.580	27	14 20.14	190.28			
15	3	51	10.171	126.430	22	18 24.57	15	5	38	18.948	140.801	27	17 30.42	181.61			
16	3	53	16.601	126.766	22	27 20.32	16	5	40	39.749	141.018	27	20 32.03	172.87			
17	3	55	23.367	127.102	22	36 10.17	17	5	43	00.767	141.229	27	23 24.90	164.11			
18	3	57	30.469	127.438	22	44 54.04	18	5	45	21.996	141.435	27	26 09.01	155.30			
19	3	59	37.907	127.775	22	53 31.80	19	5	47	43.431	141.635	27	28 44.31	146.44			
20	4	01	45.682	128.109	23	02 03.63	20	5	50	05.066	141.831	27	31 10.75	137.55			
21	4	03	53.791	128.446	23	10 29.21	21	5	52	26.897	142.020	27	33 28.30	128.62			
22	4	06	02.237	128.781	23	18 48.55	22	5	54	48.917	142.205	27	35 36.92	119.66			
23	4	08	11.018	129.115	23	27 01.59	23	5	57	11.122	142.383	27	37 36.58	+110.65			
24	4	10	20.133		+23	35 08.27	24	5	59	33.505		+27	39 27.23				

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
May 13							May 15						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	5	59	33.505	142°555	+27	39 27.23	0	7	54	57.076	143°607	+26	05 00.93
1	6	01	56.060	142°722	27	41 08.84	1	7	57	20.683	143°490	25	59 12.95
2	6	04	18.782	142°883	27	42 41.39	2	7	59	44.173	143°367	25	53 15.81
3	6	06	41.665	143°038	27	44 04.83	3	8	02	07.540	143°239	25	47 09.55
4	6	09	04.703	143°187	27	45 19.13	4	8	04	30.779	143°109	25	40 54.20
5	6	11	27.890	143°330	27	46 24.27	5	8	06	53.888	142°973	25	34 29.78
6	6	13	51.220	143°467	27	47 20.21	6	8	09	16.861	142°833	25	27 56.34
7	6	16	14.687	143°597	27	48 06.94	7	8	11	39.694	142°689	25	21 13.90
8	6	18	38.284	143°722	27	48 44.41	8	8	14	02.383	142°543	25	14 22.51
9	6	21	02.006	143°840	27	49 12.62	9	8	16	24.926	142°391	25	07 22.19
10	6	23	25.846	143°952	27	49 31.52	10	8	18	47.317	142°236	25	00 12.99
11	6	25	49.798	144°057	27	49 41.11	11	8	21	09.553	142°079	24	52 54.94
12	6	28	13.855	144°157	27	49 41.36	12	8	23	31.632	141°917	24	45 28.09
13	6	30	38.012	144°249	27	49 32.24	13	8	25	53.549	141°752	24	37 52.48
14	6	33	02.261	144°336	27	49 13.75	14	8	28	15.301	141°585	24	30 08.14
15	6	35	26.597	144°416	27	48 45.86	15	8	30	36.886	141°414	24	22 15.12
16	6	37	51.013	144°490	27	48 08.56	16	8	32	58.300	141°241	24	14 13.46
17	6	40	15.503	144°557	27	47 21.83	17	8	35	19.541	141°064	24	06 03.21
18	6	42	40.060	144°618	27	46 25.66	18	8	37	40.605	140°886	23	57 44.41
19	6	45	04.678	144°673	27	45 20.04	19	8	40	01.491	140°705	23	49 17.11
20	6	47	29.351	144°720	27	44 04.95	20	8	42	22.196	140°521	23	40 41.36
21	6	49	54.071	144°763	27	42 40.40	21	8	44	42.717	140°335	23	31 57.20
22	6	52	18.834	144°797	27	41 06.36	22	8	47	03.052	140°149	23	23 04.68
23	6	54	43.631	144°826	+27	39 22.84	23	8	49	23.201	139°958	+23	14 03.86
May 14							May 16						
0	6	57	08.457	144°849	+27	37 29.83	0	8	51	43.159	139°767	+23	04 54.77
1	6	59	33.306	144°865	27	35 27.33	1	8	54	02.926	139°575	22	55 37.48
2	7	01	58.171	144°875	27	33 15.32	2	8	56	22.501	139°380	22	46 12.04
3	7	04	23.046	144°879	27	30 53.82	3	8	58	41.881	139°184	22	36 38.49
4	7	06	47.925	144°876	27	28 22.82	4	9	01	01.065	138°987	22	26 56.90
5	7	09	12.801	144°867	27	25 42.33	5	9	03	20.052	138°789	22	17 07.31
6	7	11	37.668	144°853	27	22 52.34	6	9	05	38.841	138°590	22	07 09.79
7	7	14	02.521	144°831	27	19 52.87	7	9	07	57.431	138°389	21	57 04.38
8	7	16	27.352	144°804	27	16 43.91	8	9	10	15.820	138°190	21	46 51.14
9	7	18	52.156	144°772	27	13 25.48	9	9	12	34.010	137°987	21	36 30.14
10	7	21	16.928	144°732	27	09 57.58	10	9	14	51.997	137°786	21	26 01.42
11	7	23	41.660	144°688	27	06 20.22	11	9	17	09.783	137°584	21	15 25.05
12	7	26	06.348	144°637	27	02 33.42	12	9	19	27.367	137°382	21	04 41.09
13	7	28	30.985	144°580	26	58 37.19	13	9	21	44.749	137°178	20	53 49.59
14	7	30	55.565	144°519	26	54 31.54	14	9	24	01.927	136°977	20	42 50.61
15	7	33	20.084	144°451	26	50 16.48	15	9	26	18.904	136°774	20	31 44.23
16	7	35	44.535	144°378	26	45 52.04	16	9	28	35.678	136°572	20	20 30.49
17	7	38	08.913	144°300	26	41 18.22	17	9	30	52.250	136°371	20	09 09.46
18	7	40	33.213	144°217	26	36 35.06	18	9	33	08.621	136°169	19	57 41.20
19	7	42	57.430	144°127	26	31 42.57	19	9	35	24.790	135°969	19	46 05.77
20	7	45	21.557	144°033	26	26 40.76	20	9	37	40.759	135°769	19	34 23.25
21	7	47	45.590	143°934	26	21 29.67	21	9	39	56.528	135°570	19	22 33.68
22	7	50	09.524	143°830	26	16 09.32	22	9	42	12.098	135°372	19	10 37.15
23	7	52	33.354	143°722	26	10 39.73	23	9	44	27.470	135°175	18	58 33.70
24	7	54	57.076		+26	05 00.93	24	9	46	42.645		+18	46 23.42

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
May 17			May 19		
h	h m s	° ' "	h	h m s	° ' "
0	9 46 42.645 ^s 134.980	+18 46 23.42 ["] -737.06	0	11 31 44.503 ^s 128.754	+7 11 19.40 ["] -976.16
1	9 48 57.625 ^s 134.785	18 34 06.36 ["] 743.77	1	11 33 53.257 ^s 128.720	6 55 03.24 ["] 979.17
2	9 51 12.410 ^s 134.592	18 21 42.59 ["] 750.42	2	11 36 01.977 ^s 128.690	6 38 44.07 ["] 982.10
3	9 53 27.002 ^s 134.400	18 09 12.17 ["] 756.98	3	11 38 10.667 ^s 128.664	6 22 21.97 ["] 984.94
4	9 55 41.402 ^s 134.210	17 56 35.19 ["] 763.50	4	11 40 19.331 ^s 128.644	6 05 57.03 ["] 987.70
5	9 57 55.612 ^s 134.023	17 43 51.69 ["] 769.93	5	11 42 27.975 ^s 128.628	5 49 29.33 ["] 990.37
6	10 00 09.635 ^s 133.836	17 31 01.76 ["] 776.30	6	11 44 36.603 ^s 128.618	5 32 58.96 ["] 992.93
7	10 02 23.471 ^s 133.651	17 18 05.46 ["] 782.60	7	11 46 45.221 ^s 128.611	5 16 26.03 ["] 995.43
8	10 04 37.122 ^s 133.469	17 05 02.86 ["] 788.84	8	11 48 53.832 ^s 128.611	4 59 50.60 ["] 997.82
9	10 06 50.591 ^s 133.289	16 51 54.02 ["] 794.99	9	11 51 02.443 ^s 128.615	4 43 12.78 ["] 1000.13
10	10 09 03.880 ^s 133.110	16 38 39.03 ["] 801.08	10	11 53 11.058 ^s 128.624	4 26 32.65 ["] 1002.33
11	10 11 16.990 ^s 132.935	16 25 17.95 ["] 807.10	11	11 55 19.682 ^s 128.638	4 09 50.32 ["] 1004.46
12	10 13 29.925 ^s 132.761	16 11 50.85 ["] 813.05	12	11 57 28.320 ^s 128.657	3 53 05.86 ["] 1006.49
13	10 15 42.686 ^s 132.591	15 58 17.80 ["] 818.92	13	11 59 36.977 ^s 128.681	3 36 19.37 ["] 1008.43
14	10 17 55.277 ^s 132.421	15 44 38.88 ["] 824.72	14	12 01 45.658 ^s 128.710	3 19 30.94 ["] 1010.26
15	10 20 07.698 ^s 132.257	15 30 54.16 ["] 830.46	15	12 03 54.368 ^s 128.744	3 02 40.68 ["] 1012.02
16	10 22 19.955 ^s 132.093	15 17 03.70 ["] 836.11	16	12 06 03.112 ^s 128.783	2 45 48.66 ["] 1013.67
17	10 24 32.048 ^s 131.933	15 03 07.59 ["] 841.69	17	12 08 11.895 ^s 128.828	2 28 54.99 ["] 1015.23
18	10 26 43.981 ^s 131.776	14 49 05.90 ["] 847.21	18	12 10 20.723 ^s 128.877	2 11 59.76 ["] 1016.69
19	10 28 55.757 ^s 131.621	14 34 58.69 ["] 852.64	19	12 12 29.600 ^s 128.932	1 55 03.07 ["] 1018.06
20	10 31 07.378 ^s 131.470	14 20 46.05 ["] 858.00	20	12 14 38.532 ^s 128.992	1 38 05.01 ["] 1019.32
21	10 33 18.848 ^s 131.323	14 06 28.05 ["] 863.29	21	12 16 47.524 ^s 129.057	1 21 05.69 ["] 1020.50
22	10 35 30.171 ^s 131.177	13 52 04.76 ["] 868.50	22	12 18 56.581 ^s 129.127	1 04 05.19 ["] 1021.58
23	10 37 41.348 ^s 131.036	+13 37 36.26 ["] -873.63	23	12 21 05.708 ^s 129.202	+0 47 03.61 ["] -1022.55
May 18			May 20		
0	10 39 52.384 ^s 130.897	+13 23 02.63 ["] -878.69	0	12 23 14.910 ^s 129.282	+0 30 01.06 ["] -1023.43
1	10 42 03.281 ^s 130.763	13 08 23.94 ["] 883.67	1	12 25 24.192 ^s 129.368	+0 12 57.63 ["] -1024.21
2	10 44 14.044 ^s 130.632	12 53 40.27 ["] 888.58	2	12 27 33.560 ^s 129.459	-0 04 06.58 ["] -1024.89
3	10 46 24.676 ^s 130.504	12 38 51.69 ["] 893.40	3	12 29 43.019 ^s 129.555	0 21 11.47 ["] -1025.46
4	10 48 35.180 ^s 130.380	12 23 58.29 ["] 898.16	4	12 31 52.574 ^s 129.657	0 38 16.93 ["] -1025.94
5	10 50 45.560 ^s 130.260	12 09 00.13 ["] 902.82	5	12 34 02.231 ^s 129.762	0 55 22.87 ["] -1026.31
6	10 52 55.820 ^s 130.143	11 53 57.31 ["] 907.42	6	12 36 11.993 ^s 129.874	1 12 29.18 ["] -1026.58
7	10 55 05.963 ^s 130.031	11 38 49.89 ["] 911.93	7	12 38 21.867 ^s 129.991	1 29 35.76 ["] -1026.75
8	10 57 15.994 ^s 129.922	11 23 37.96 ["] 916.36	8	12 40 31.858 ^s 130.113	1 46 42.51 ["] -1026.82
9	10 59 25.916 ^s 129.817	11 08 21.60 ["] 920.72	9	12 42 41.971 ^s 130.239	2 03 49.33 ["] -1026.78
10	11 01 35.733 ^s 129.716	10 53 00.88 ["] 924.99	10	12 44 52.210 ^s 130.372	2 20 56.11 ["] -1026.63
11	11 03 45.449 ^s 129.619	10 37 35.89 ["] 929.18	11	12 47 02.582 ^s 130.509	2 38 02.74 ["] -1026.38
12	11 05 55.068 ^s 129.527	10 22 06.71 ["] 933.30	12	12 49 13.091 ^s 130.652	2 55 09.12 ["] -1026.03
13	11 08 04.595 ^s 129.438	10 06 33.41 ["] 937.33	13	12 51 23.743 ^s 130.800	3 12 15.15 ["] -1025.57
14	11 10 14.033 ^s 129.354	9 50 56.08 ["] 941.27	14	12 53 34.543 ^s 130.952	3 29 20.72 ["] -1024.99
15	11 12 23.387 ^s 129.274	9 35 14.81 ["] 945.14	15	12 55 45.495 ^s 131.109	3 46 25.71 ["] -1024.33
16	11 14 32.661 ^s 129.198	9 19 29.67 ["] 948.93	16	12 57 56.604 ^s 131.273	4 03 30.04 ["] -1023.53
17	11 16 41.859 ^s 129.128	9 03 40.74 ["] 952.62	17	13 00 07.877 ^s 131.440	4 20 33.57 ["] -1022.64
18	11 18 50.987 ^s 129.060	8 47 48.12 ["] 956.24	18	13 02 19.317 ^s 131.614	4 37 36.21 ["] -1021.65
19	11 21 00.047 ^s 128.998	8 31 51.88 ["] 959.77	19	13 04 30.931 ^s 131.791	4 54 37.86 ["] -1020.52
20	11 23 09.045 ^s 128.940	8 15 52.11 ["] 963.22	20	13 06 42.722 ^s 131.973	5 11 38.38 ["] -1019.31
21	11 25 17.985 ^s 128.886	7 59 48.89 ["] 966.58	21	13 08 54.695 ^s 132.162	5 28 37.69 ["] -1017.97
22	11 27 26.871 ^s 128.838	7 43 42.31 ["] 969.86	22	13 11 06.857 ^s 132.354	5 45 35.66 ["] -1016.52
23	11 29 35.709 ^s 128.794	7 27 32.45 ["] -973.05	23	13 13 19.211 ^s 132.551	6 02 32.18 ["] -1014.97
24	11 31 44.503 ^s	+7 11 19.40 ["]	24	13 15 31.762 ^s	-6 19 27.15 ["]

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
May 21			May 23		
h	h m s	° ' " "	h	h m s	° ' " "
0	13 15 31.762	132° 754	0	15 06 46.501	-18 42 37.45
1	13 17 44.516	132° 961	1	15 09 13.264	18 55 51.43
2	13 19 57.477	133° 172	2	15 11 40.365	19 08 57.91
3	13 22 10.649	133° 389	3	15 14 07.803	19 21 56.78
4	13 24 24.038	133° 610	4	15 16 35.577	19 34 47.92
5	13 26 37.648	133° 836	5	15 19 03.686	19 47 31.21
6	13 28 51.484	134° 066	6	15 21 32.129	20 00 06.55
7	13 31 05.550	134° 301	7	15 24 00.905	20 12 33.83
8	13 33 19.851	134° 540	8	15 26 30.012	20 24 52.93
9	13 35 34.391	134° 783	9	15 28 59.448	20 37 03.74
10	13 37 49.174	135° 032	10	15 31 29.212	20 49 06.16
11	13 40 04.206	135° 283	11	15 33 59.300	21 01 00.07
12	13 42 19.489	135° 541	12	15 36 29.712	21 12 45.38
13	13 44 35.030	135° 800	13	15 39 00.444	21 24 21.98
14	13 46 50.830	136° 065	14	15 41 31.493	21 35 49.76
15	13 49 06.895	136° 334	15	15 44 02.857	21 47 08.62
16	13 51 23.229	136° 606	16	15 46 34.532	21 58 18.46
17	13 53 39.835	136° 883	17	15 49 06.515	22 09 19.19
18	13 55 56.718	137° 162	18	15 51 38.802	22 20 10.69
19	13 58 13.880	137° 446	19	15 54 11.389	22 30 52.88
20	14 00 31.326	137° 734	20	15 56 44.272	22 41 25.66
21	14 02 49.060	138° 024	21	15 59 17.448	22 51 48.93
22	14 05 07.084	138° 318	22	16 01 50.911	23 02 02.61
23	14 07 25.402	138° 616	23	16 04 24.657	-23 12 06.60
					-594.21
May 22			May 24		
0	14 09 44.018	-12 52 39.56	0	16 06 58.680	-23 22 00.81
1	14 12 02.934	138° 916	1	16 09 32.977	23 31 45.16
2	14 14 22.154	139° 220	2	16 12 07.541	23 41 19.56
3	14 16 41.680	139° 526	3	16 14 42.367	23 50 43.93
4	14 19 01.516	139° 836	4	16 17 17.449	23 59 58.19
5	14 21 21.664	140° 148	5	16 19 52.781	24 09 02.26
6	14 23 42.127	140° 463	6	16 22 28.357	24 17 56.05
7	14 26 02.908	140° 781	7	16 25 04.171	24 26 39.50
8	14 28 24.008	141° 100	8	16 27 40.216	24 35 12.53
9	14 30 45.430	141° 422	9	16 30 16.485	24 43 35.07
10	14 33 07.176	142° 072	10	16 32 52.971	24 51 47.05
11	14 35 29.248	142° 400	11	16 35 29.667	24 59 48.40
12	14 37 51.648	142° 730	12	16 38 06.567	25 07 39.06
13	14 40 14.378	143° 061	13	16 40 43.661	25 15 18.97
14	14 42 37.439	143° 393	14	16 43 20.944	25 22 48.06
15	14 45 00.832	143° 728	15	16 45 58.406	25 30 06.28
16	14 47 24.560	144° 063	16	16 48 36.039	25 37 13.56
17	14 49 48.623	144° 398	17	16 51 13.836	25 44 09.87
18	14 52 13.021	144° 735	18	16 53 51.788	25 50 55.15
19	14 54 37.756	145° 073	19	16 56 29.887	25 57 29.34
20	14 57 02.829	145° 411	20	16 59 08.123	26 03 52.41
21	14 59 28.240	145° 749	21	17 01 46.488	26 10 04.31
22	15 01 53.989	146° 087	22	17 04 24.973	26 16 05.00
23	15 04 20.076	146° 425	23	17 07 03.568	26 21 54.44
24	15 06 46.501	-18 42 37.45	24	17 09 42.265	-26 27 32.60
					-338.16

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
May 25							May 27						
h	m	s		°	'	"	h	m	s		°	'	"
0	17	09	42.265	158.790	-26	27 32.60	0	19	15	24.336	151.628	-27	16 07.95
1	17	12	21.055	158.872	26	32 59.44	1	19	17	55.964	151.264	27	12 43.11
2	17	14	59.927	158.945	26	38 14.93	2	19	20	27.228	150.894	27	09 08.38
3	17	17	38.872	159.009	26	43 19.05	3	19	22	58.122	150.518	27	05 23.82
4	17	20	17.881	159.062	26	48 11.76	4	19	25	28.640	150.136	27	01 29.52
5	17	22	56.943	159.105	26	52 53.06	5	19	27	58.776	149.747	26	57 25.55
6	17	25	36.048	159.140	26	57 22.91	6	19	30	28.523	149.354	26	53 12.01
7	17	28	15.188	159.163	27	01 41.30	7	19	32	57.877	148.955	26	48 48.97
8	17	30	54.351	159.176	27	05 48.21	8	19	35	26.832	148.550	26	44 16.51
9	17	33	33.527	159.180	27	09 43.64	9	19	37	55.382	148.142	26	39 34.73
10	17	36	12.707	159.173	27	13 27.58	10	19	40	23.524	147.728	26	34 43.70
11	17	38	51.880	159.155	27	17 00.01	11	19	42	51.252	147.309	26	29 43.51
12	17	41	31.035	159.129	27	20 20.94	12	19	45	18.561	146.887	26	24 34.25
13	17	44	10.164	159.090	27	23 30.36	13	19	47	45.448	146.460	26	19 16.00
14	17	46	49.254	159.043	27	26 28.27	14	19	50	11.908	146.030	26	13 48.86
15	17	49	28.297	158.984	27	29 14.69	15	19	52	37.938	145.595	26	08 12.91
16	17	52	07.281	158.915	27	31 49.61	16	19	55	03.533	145.158	26	02 28.25
17	17	54	46.196	158.836	27	34 13.04	17	19	57	28.691	144.716	25	56 34.95
18	17	57	25.032	158.747	27	36 25.01	18	19	59	53.407	144.272	25	50 33.12
19	18	00	03.779	158.647	27	38 25.51	19	20	02	17.679	143.825	25	44 22.84
20	18	02	42.426	158.536	27	40 14.57	20	20	04	41.504	143.376	25	38 04.20
21	18	05	20.962	158.417	27	41 52.22	21	20	07	04.880	142.923	25	31 37.29
22	18	07	59.379	158.286	27	43 18.46	22	20	09	27.803	142.469	25	25 02.22
23	18	10	37.665	158.145	-27	44 33.33	23	20	11	50.272	142.012	-25	18 19.06
May 26							May 28						
0	18	13	15.810	157.994	-27	45 36.85	0	20	14	12.284	141.553	-25	11 27.91
1	18	15	53.804	157.833	27	46 29.06	1	20	16	33.837	141.093	25	04 28.86
2	18	18	31.637	157.663	27	47 09.98	2	20	18	54.930	140.632	24	57 22.01
3	18	21	09.300	157.482	27	47 39.65	3	20	21	15.562	140.168	24	50 07.45
4	18	23	46.782	157.292	27	47 58.11	4	20	23	35.730	139.705	24	42 45.26
5	18	26	24.074	157.091	27	48 05.39	5	20	25	55.435	139.239	24	35 15.55
6	18	29	01.165	156.883	27	48 01.54	6	20	28	14.674	138.773	24	27 38.40
7	18	31	38.048	156.663	27	47 46.59	7	20	30	33.447	138.306	24	19 53.91
8	18	34	14.711	156.434	27	47 20.61	8	20	32	51.753	137.839	24	12 02.16
9	18	36	51.145	156.197	27	46 43.63	9	20	35	09.592	137.372	24	04 03.26
10	18	39	27.342	155.951	27	45 55.70	10	20	37	26.964	136.905	23	55 57.29
11	18	42	03.293	155.695	27	44 56.88	11	20	39	43.869	136.437	23	47 44.34
12	18	44	38.988	155.430	27	43 47.21	12	20	42	00.306	135.970	23	39 24.50
13	18	47	14.418	155.157	27	42 26.77	13	20	44	16.276	135.503	23	30 57.88
14	18	49	49.575	154.875	27	40 55.59	14	20	46	31.779	135.036	23	22 24.55
15	18	52	24.450	154.586	27	39 13.75	15	20	48	46.815	134.571	23	13 44.60
16	18	54	59.036	154.287	27	37 21.31	16	20	51	01.386	134.107	23	04 58.13
17	18	57	33.323	153.982	27	35 18.33	17	20	53	15.493	133.642	22	56 05.23
18	19	00	07.305	153.667	27	33 04.86	18	20	55	29.135	133.180	22	47 05.99
19	19	02	40.972	153.345	27	30 40.99	19	20	57	42.315	132.718	22	38 00.49
20	19	05	14.317	153.017	27	28 06.78	20	20	59	55.033	132.257	22	28 48.82
21	19	07	47.334	152.680	27	25 22.30	21	21	02	07.290	131.800	22	19 31.07
22	19	10	20.014	152.336	27	22 27.62	22	21	04	19.090	131.342	22	10 07.33
23	19	12	52.350	151.986	27	19 22.81	23	21	06	30.432	130.887	22	00 37.69
24	19	15	24.336		-27	16 07.95	24	21	08	41.319		-21	51 02.23

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
May 29									May 31								
h	h	m	s	s	°	'	"	"	h	h	m	s	s	°	'	"	"
0	21	08	41.319		-21	51	02.23	+581.20	0	22	45	26.382		-12	42	11.81	
1	21	10	51.752	130.433	21	41	21.03	586.84	1	22	47	18.922	112.540	12	29	23.64	+768.17
2	21	13	01.734	129.982	21	31	34.19	592.41	2	22	49	11.191	112.269	12	16	33.14	770.50
3	21	15	11.267	129.533	21	21	41.78	597.89	3	22	51	03.194	112.003	12	03	40.37	772.77
4	21	17	20.353	129.086	21	11	43.89	603.28	4	22	52	54.937	111.743	11	50	45.37	775.00
5	21	19	28.995	128.642	21	01	40.61	608.59	5	22	54	46.422	111.485	11	37	48.20	777.17
6	21	21	37.194	128.199	20	51	32.02	613.83	6	22	56	37.657	111.235	11	24	48.92	779.28
7	21	23	44.953	127.759	20	41	18.19	618.97	7	22	58	28.644	110.987	11	11	47.56	781.36
8	21	25	52.275	127.322	20	30	59.22	624.04	8	23	00	19.388	110.744	10	58	44.18	783.38
9	21	27	59.163	126.888	20	20	35.18	629.03	9	23	02	09.895	110.507	10	45	38.84	785.34
10	21	30	05.619	126.456	20	10	06.15	633.93	10	23	04	00.169	110.274	10	32	31.58	787.26
11	21	32	11.647	126.028	19	59	32.22	638.77	11	23	05	50.215	110.046	10	19	22.45	789.13
12	21	34	17.249	125.602	19	48	53.45	643.51	12	23	07	40.037	109.822	10	06	11.51	790.94
13	21	36	22.429	125.180	19	38	09.94	648.19	13	23	09	29.641	109.604	9	52	58.79	792.72
14	21	38	27.190	124.761	19	27	21.75	652.79	14	23	11	19.031	109.390	9	39	44.35	794.44
15	21	40	31.535	124.345	19	16	28.96	657.30	15	23	13	08.211	109.180	9	26	28.24	796.11
16	21	42	35.466	123.931	19	05	31.66	661.75	16	23	14	57.186	108.975	9	13	10.49	797.75
17	21	44	38.989	123.523	18	54	29.91	666.11	17	23	16	45.962	108.776	8	59	51.17	799.32
18	21	46	42.106	123.117	18	43	23.80	670.41	18	23	18	34.543	108.581	8	46	30.31	800.86
19	21	48	44.820	122.714	18	32	13.39	674.63	19	23	20	22.933	108.390	8	33	07.97	802.34
20	21	50	47.136	122.316	18	20	58.76	678.78	20	23	22	11.138	108.205	8	19	44.18	803.79
21	21	52	49.057	121.921	18	09	39.98	682.86	21	23	23	59.162	108.024	8	06	18.99	805.19
22	21	54	50.587	121.530	17	58	17.12	686.86	22	23	25	47.009	107.847	7	52	52.45	806.54
23	21	56	51.729	121.142	-17	46	50.26	+690.80	23	23	27	34.686	107.677	7	39	24.60	807.85
				120.758									107.509				+809.11
May 30									June 1								
0	21	58	52.487		-17	35	19.46	+694.66	0	23	29	22.195		-7	25	55.49	+810.33
1	22	00	52.866	120.379	17	23	44.80	698.46	1	23	31	09.543	107.348	7	12	25.16	811.51
2	22	02	52.869	120.003	17	12	06.34	702.18	2	23	32	56.733	107.190	6	58	53.65	812.64
3	22	04	52.500	119.631	17	00	24.16	705.84	3	23	34	43.771	107.038	6	45	21.01	813.73
4	22	06	51.764	119.264	16	48	38.32	709.43	4	23	36	30.661	106.890	6	31	47.28	814.78
5	22	08	50.664	118.900	16	36	48.89	712.96	5	23	38	17.407	106.746	6	18	12.50	815.79
6	22	10	49.204	118.540	16	24	55.93	716.42	6	23	40	04.016	106.609	6	04	36.71	816.75
7	22	12	47.390	118.186	16	12	59.51	719.81	7	23	41	50.491	106.475	5	50	59.96	817.67
8	22	14	45.224	117.834	16	00	59.70	723.14	8	23	43	36.836	106.345	5	37	22.29	818.55
9	22	16	42.711	117.487	15	48	56.56	726.40	9	23	45	23.058	106.222	5	23	43.74	819.38
10	22	18	39.855	117.144	15	36	50.16	729.61	10	23	47	09.160	106.102	5	10	04.36	820.19
11	22	20	36.662	116.807	15	24	40.55	732.75	11	23	48	55.147	105.987	4	56	24.17	820.94
12	22	22	33.134	116.472	15	12	27.80	735.82	12	23	50	41.024	105.877	4	42	43.23	821.66
13	22	24	29.277	116.143	15	00	11.98	738.84	13	23	52	26.795	105.771	4	29	01.57	822.33
14	22	26	25.095	115.818	14	47	53.14	741.80	14	23	54	12.465	105.670	4	15	19.24	822.96
15	22	28	20.592	115.497	14	35	31.34	744.70	15	23	55	58.040	105.575	4	01	36.28	823.56
16	22	30	15.773	115.181	14	23	06.64	747.53	16	23	57	43.522	105.482	3	47	52.72	824.12
17	22	32	10.643	114.870	14	10	39.11	750.31	17	23	59	28.918	105.396	3	34	08.60	824.63
18	22	34	05.205	114.562	13	58	08.80	753.03	18	0	01	14.232	105.314	3	20	23.97	825.10
19	22	35	59.464	114.259	13	45	35.77	755.69	19	0	02	59.468	105.236	3	06	38.87	825.54
20	22	37	53.426	113.962	13	33	00.08	758.30	20	0	04	44.631	105.163	2	52	53.33	825.93
21	22	39	47.094	113.668	13	20	21.78	760.85	21	0	06	29.725	105.094	2	39	07.40	826.30
22	22	41	40.473	113.379	13	07	40.93	763.34	22	0	08	14.756	105.031	2	25	21.10	826.60
23	22	43	33.567	113.094	12	54	57.59	+765.78	23	0	09	59.728	104.972	2	11	34.50	+826.89
24	22	45	26.382	112.815	-12	42	11.81		24	0	11	44.645	104.917	1	57	47.61	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
June 2			June 4		
h	h m s	° ' "	h	h m s	° ' "
0	0 11 44.645 ^{104.868}	- 1 57 47.61 ^{+827.12}	0	1 36 05.073 ^{107.733}	+ 8 56 19.54 ^{+791.85}
1	0 13 29.513 ^{104.822}	1 44 00.49 ^{827.32}	1	1 37 52.806 ^{107.898}	9 09 31.39 ^{790.07}
2	0 15 14.335 ^{104.782}	1 30 13.17 ^{827.49}	2	1 39 40.704 ^{108.068}	9 22 41.46 ^{788.26}
3	0 16 59.117 ^{104.745}	1 16 25.68 ^{827.60}	3	1 41 28.772 ^{108.241}	9 35 49.72 ^{786.40}
4	0 18 43.862 ^{104.714}	1 02 38.08 ^{827.69}	4	1 43 17.013 ^{108.419}	9 48 56.12 ^{784.49}
5	0 20 28.576 ^{104.687}	0 48 50.39 ^{827.73}	5	1 45 05.432 ^{108.601}	10 02 00.61 ^{782.53}
6	0 22 13.263 ^{104.664}	0 35 02.66 ^{827.74}	6	1 46 54.033 ^{108.787}	10 15 03.14 ^{780.53}
7	0 23 57.927 ^{104.647}	0 21 14.92 ^{827.71}	7	1 48 42.820 ^{108.977}	10 28 03.67 ^{778.48}
8	0 25 42.574 ^{104.633}	- 0 07 27.21 ^{827.63}	8	1 50 31.797 ^{109.170}	10 41 02.15 ^{776.37}
9	0 27 27.207 ^{104.625}	+ 0 06 20.42 ^{827.52}	9	1 52 20.967 ^{109.368}	10 53 58.52 ^{774.22}
10	0 29 11.832 ^{104.620}	0 20 07.94 ^{827.37}	10	1 54 10.335 ^{109.570}	11 06 52.74 ^{772.02}
11	0 30 56.452 ^{104.620}	0 33 55.31 ^{827.18}	11	1 55 59.905 ^{109.776}	11 19 44.76 ^{769.78}
12	0 32 41.072 ^{104.626}	0 47 42.49 ^{826.95}	12	1 57 49.681 ^{109.986}	11 32 34.54 ^{767.47}
13	0 34 25.698 ^{104.634}	1 01 29.44 ^{826.69}	13	1 59 39.667 ^{110.199}	11 45 22.01 ^{765.13}
14	0 36 10.332 ^{104.649}	1 15 16.13 ^{826.38}	14	2 01 29.866 ^{110.416}	11 58 07.14 ^{762.72}
15	0 37 54.981 ^{104.666}	1 29 02.51 ^{826.03}	15	2 03 20.282 ^{110.638}	12 10 49.86 ^{760.28}
16	0 39 39.647 ^{104.690}	1 42 48.54 ^{825.66}	16	2 05 10.920 ^{110.863}	12 23 30.14 ^{757.77}
17	0 41 24.337 ^{104.716}	1 56 34.20 ^{825.22}	17	2 07 01.783 ^{111.091}	12 36 07.91 ^{755.21}
18	0 43 09.053 ^{104.749}	2 10 19.42 ^{824.77}	18	2 08 52.874 ^{111.324}	12 48 43.12 ^{752.61}
19	0 44 53.802 ^{104.784}	2 24 04.19 ^{824.27}	19	2 10 44.198 ^{111.561}	13 01 15.73 ^{749.94}
20	0 46 38.586 ^{104.825}	2 37 48.46 ^{823.72}	20	2 12 35.759 ^{111.801}	13 13 45.67 ^{747.24}
21	0 48 23.411 ^{104.871}	2 51 32.18 ^{823.14}	21	2 14 27.560 ^{112.044}	13 26 12.91 ^{744.46}
22	0 50 08.282 ^{104.919}	3 05 15.32 ^{822.52}	22	2 16 19.604 ^{112.292}	13 38 37.37 ^{741.65}
23	0 51 53.201 ^{104.974}	+ 3 18 57.84 ^{+821.87}	23	2 18 11.896 ^{112.543}	+ 13 50 59.02 ^{+738.76}
June 3			June 5		
0	0 53 38.175 ^{105.032}	+ 3 32 39.71 ^{+821.16}	0	2 20 04.439 ^{112.797}	+ 14 03 17.78 ^{+735.84}
1	0 55 23.207 ^{105.095}	3 46 20.87 ^{820.42}	1	2 21 57.236 ^{113.056}	14 15 33.62 ^{732.85}
2	0 57 08.302 ^{105.162}	4 00 01.29 ^{819.64}	2	2 23 50.292 ^{113.317}	14 27 46.47 ^{729.81}
3	0 58 53.464 ^{105.234}	4 13 40.93 ^{818.82}	3	2 25 43.609 ^{113.582}	14 39 56.28 ^{726.71}
4	1 00 38.698 ^{105.309}	4 27 19.75 ^{817.96}	4	2 27 37.191 ^{113.851}	14 52 02.99 ^{723.56}
5	1 02 24.007 ^{105.390}	4 40 57.71 ^{817.05}	5	2 29 31.042 ^{114.122}	15 04 06.55 ^{720.35}
6	1 04 09.397 ^{105.474}	4 54 34.76 ^{816.11}	6	2 31 25.164 ^{114.398}	15 16 06.90 ^{717.07}
7	1 05 54.871 ^{105.564}	5 08 10.87 ^{815.13}	7	2 33 19.562 ^{114.677}	15 28 03.97 ^{713.75}
8	1 07 40.435 ^{105.657}	5 21 46.00 ^{814.10}	8	2 35 14.239 ^{114.958}	15 39 57.72 ^{710.36}
9	1 09 26.092 ^{105.755}	5 35 20.10 ^{813.03}	9	2 37 09.197 ^{115.243}	15 51 48.08 ^{706.92}
10	1 11 11.847 ^{105.856}	5 48 53.13 ^{811.92}	10	2 39 04.440 ^{115.532}	16 03 35.00 ^{703.42}
11	1 12 57.703 ^{105.963}	6 02 25.05 ^{810.77}	11	2 40 59.972 ^{115.823}	16 15 18.42 ^{699.85}
12	1 14 43.666 ^{106.074}	6 15 55.82 ^{809.58}	12	2 42 55.795 ^{116.117}	16 26 58.27 ^{696.23}
13	1 16 29.740 ^{106.189}	6 29 25.40 ^{808.34}	13	2 44 51.912 ^{116.415}	16 38 34.50 ^{692.55}
14	1 18 15.929 ^{106.308}	6 42 53.74 ^{807.06}	14	2 46 48.327 ^{116.715}	16 50 07.05 ^{688.80}
15	1 20 02.237 ^{106.431}	6 56 20.80 ^{805.73}	15	2 48 45.042 ^{117.018}	17 01 35.85 ^{685.00}
16	1 21 48.668 ^{106.559}	7 09 46.53 ^{804.37}	16	2 50 42.060 ^{117.325}	17 13 00.85 ^{681.13}
17	1 23 35.227 ^{106.691}	7 23 10.90 ^{802.96}	17	2 52 39.385 ^{117.633}	17 24 21.98 ^{677.20}
18	1 25 21.918 ^{106.828}	7 36 33.86 ^{801.51}	18	2 54 37.018 ^{117.946}	17 35 39.18 ^{673.21}
19	1 27 08.746 ^{106.968}	7 49 55.37 ^{800.01}	19	2 56 34.964 ^{118.260}	17 46 52.39 ^{669.16}
20	1 28 55.714 ^{107.112}	8 03 15.38 ^{798.46}	20	2 58 33.224 ^{118.577}	17 58 01.55 ^{665.04}
21	1 30 42.826 ^{107.261}	8 16 33.84 ^{796.88}	21	3 00 31.801 ^{118.896}	18 09 06.59 ^{660.85}
22	1 32 30.087 ^{107.415}	8 29 50.72 ^{795.25}	22	3 02 30.697 ^{119.219}	18 20 07.44 ^{656.61}
23	1 34 17.502 ^{107.571}	8 43 05.97 ^{+793.57}	23	3 04 29.916 ^{119.543}	18 31 04.05 ^{+652.30}
24	1 36 05.073	+ 8 56 19.54	24	3 06 29.459	+ 18 41 56.35

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
June 6							June 8						
^h	^h	^m	^s	[°]	[']	[″]	^h	^h	^m	^s	[°]	[']	[″]
0	3 06	29.459		+18 41	56.35	+647.93	0	4 48	55.727		+25 37	07.57	
1	3 08	29.329	119.870	18 52	44.28	643.49	1	4 51	12.290	136.563	25 43	04.88	+357.31
2	3 10	29.529	120.200	19 03	27.77	638.98	2	4 53	29.175	136.885	25 48	54.45	349.57
3	3 12	30.060	120.531	19 14	06.75	634.40	3	4 55	46.379	137.204	25 54	36.22	341.77
4	3 14	30.925	120.865	19 24	41.15	629.78	4	4 58	03.900	137.521	26 00	10.12	333.90
5	3 16	32.125	121.200	19 35	10.93	625.06	5	5 00	21.733	137.833	26 05	36.09	325.97
6	3 18	33.663	121.538	19 45	35.99	620.30	6	5 02	39.875	138.142	26 10	54.07	317.98
7	3 20	35.541	121.878	19 55	56.29	615.46	7	5 04	58.322	138.447	26 16	03.99	309.92
8	3 22	37.761	122.220	20 06	11.75	610.55	8	5 07	17.070	138.748	26 21	05.80	301.81
9	3 24	40.323	122.562	20 16	22.30	605.58	9	5 09	36.116	139.046	26 25	59.42	293.62
10	3 26	43.231	122.908	20 26	27.88	600.54	10	5 11	55.454	139.338	26 25	59.42	285.39
11	3 28	46.485	123.254	20 36	28.42	595.43	11	5 14	15.082	139.628	26 30	44.81	277.10
12	3 30	50.087	123.602	20 46	23.85	590.25	12	5 16	34.994	139.912	26 35	21.91	268.74
13	3 32	54.038	123.951	20 56	14.10	585.01	13	5 18	55.186	140.192	26 44	10.98	260.33
14	3 34	58.340	124.302	21 05	59.11	579.68	14	5 21	15.654	140.468	26 48	22.85	251.87
15	3 37	02.994	124.654	21 15	38.79	574.31	15	5 23	36.392	140.738	26 52	26.19	243.34
16	3 39	08.001	125.007	21 25	13.10	568.84	16	5 25	57.395	141.003	26 56	20.96	234.77
17	3 41	13.363	125.362	21 34	41.94	563.33	17	5 28	18.659	141.264	27 00	07.09	226.13
18	3 43	19.079	125.716	21 44	05.27	557.73	18	5 30	40.179	141.520	27 03	44.55	217.46
19	3 45	25.151	126.072	21 53	23.00	552.06	19	5 33	01.948	141.769	27 07	13.27	208.72
20	3 47	31.580	126.429	22 02	35.06	546.33	20	5 35	23.962	142.014	27 10	33.20	199.93
21	3 49	38.366	126.786	22 11	41.39	540.52	21	5 37	46.215	142.253	27 13	44.31	191.11
22	3 51	45.510	127.144	22 20	41.91	534.65	22	5 40	08.701	142.486	27 16	46.53	182.22
23	3 53	53.012	127.502	+22 29	36.56	+528.71	23	5 42	31.415	142.714	+27 19	39.82	+173.29
			127.860							142.936			+164.32
June 7							June 9						
0	3 56	00.872		+22 38	25.27	+522.68	0	5 44	54.351		+27 22	24.14	+155.31
1	3 58	09.091	128.219	22 47	07.95	516.60	1	5 47	17.503	143.152	27 24	59.45	146.24
2	4 00	17.669	128.578	22 55	44.55	510.45	2	5 49	40.865	143.362	27 27	25.69	137.13
3	4 02	26.605	128.936	23 04	15.00	504.21	3	5 52	04.431	143.566	27 29	42.82	128.00
4	4 04	35.900	129.295	23 12	39.21	497.91	4	5 54	28.194	143.763	27 31	50.82	118.80
5	4 06	45.553	129.653	23 20	57.12	491.55	5	5 56	52.148	143.954	27 33	49.62	109.59
6	4 08	55.564	130.011	23 29	08.67	485.11	6	5 59	16.287	144.139	27 35	39.21	100.33
7	4 11	05.932	130.368	23 37	13.78	478.59	7	6 01	40.603	144.316	27 37	19.54	91.03
8	4 13	16.657	130.725	23 45	12.37	472.01	8	6 04	05.092	144.489	27 38	50.57	81.71
9	4 15	27.738	131.081	23 53	04.38	465.37	9	6 06	29.745	144.653	27 40	12.28	72.34
10	4 17	39.173	131.435	24 00	49.75	458.64	10	6 08	54.557	144.812	27 41	24.62	62.95
11	4 19	50.963	131.790	24 08	28.39	451.85	11	6 11	19.519	144.962	27 42	27.57	53.53
12	4 22	03.105	132.142	24 16	00.24	444.99	12	6 13	44.626	145.107	27 43	21.10	44.08
13	4 24	15.599	132.494	24 23	25.23	438.05	13	6 16	09.871	145.245	27 44	05.18	34.60
14	4 26	28.442	132.843	24 30	43.28	431.06	14	6 18	35.247	145.376	27 44	39.78	25.09
15	4 28	41.635	133.193	24 37	54.34	423.99	15	6 21	00.745	145.498	27 45	04.87	15.57
16	4 30	55.174	133.539	24 44	58.33	416.85	16	6 23	26.361	145.616	27 45	20.44	6.02
17	4 33	09.058	133.884	24 51	55.18	409.65	17	6 25	52.085	145.724	27 45	26.46	3.55
18	4 35	23.286	134.228	24 58	44.83	402.37	18	6 28	17.911	145.826	27 45	22.91	13.13
19	4 37	37.854	134.568	25 05	27.20	395.02	19	6 30	43.833	145.922	27 45	09.78	22.75
20	4 39	52.761	134.907	25 12	02.22	387.62	20	6 33	09.842	146.009	27 44	47.03	32.37
21	4 42	08.004	135.243	25 18	29.84	380.14	21	6 35	35.931	146.089	27 44	14.66	42.01
22	4 44	23.582	135.578	25 24	49.98	372.60	22	6 38	02.094	146.163	27 43	32.65	51.65
23	4 46	39.490	135.908	25 31	02.58	364.99	23	6 40	28.322	146.228	27 42	41.00	61.32
24	4 48	55.727	136.237	+25 37	07.57		24	6 42	54.609	146.287	+27 41	39.68	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
June 10							June 12						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	6 42	54.609	146.338	+27 41	39.68	71.00	0	8 38	52.028	141.257	+23 46	03.78	516.44
1	6 45	20.947	146.382	27 40	28.68	80.67	1	8 41	13.285	141.034	23 37	27.34	524.77
2	6 47	47.329	146.419	27 39	08.01	90.36	2	8 43	34.319	140.810	23 28	42.57	533.03
3	6 50	13.748	146.448	27 37	37.65	100.05	3	8 45	55.129	140.584	23 19	49.54	541.24
4	6 52	40.196	146.470	27 35	57.60	109.75	4	8 48	15.713	140.353	23 10	48.30	549.38
5	6 55	06.666	146.485	27 34	07.85	119.44	5	8 50	36.066	140.123	23 01	38.92	557.47
6	6 57	33.151	146.492	27 32	08.41	129.14	6	8 52	56.189	139.889	22 52	21.45	565.49
7	6 59	59.643	146.493	27 29	59.27	138.84	7	8 55	16.078	139.655	22 42	55.96	573.46
8	7 02	26.136	146.486	27 27	40.43	148.53	8	8 57	35.733	139.417	22 33	22.50	581.36
9	7 04	52.622	146.472	27 25	11.90	158.22	9	8 59	55.150	139.180	22 23	41.14	589.19
10	7 07	19.094	146.452	27 22	33.68	167.89	10	9 02	14.330	138.940	22 13	51.95	596.96
11	7 09	45.546	146.423	27 19	45.79	177.58	11	9 04	33.270	138.698	22 03	54.99	604.68
12	7 12	11.969	146.388	27 16	48.21	187.23	12	9 06	51.968	138.457	21 53	50.31	612.31
13	7 14	38.357	146.347	27 13	40.98	196.89	13	9 09	10.425	138.215	21 43	38.00	619.89
14	7 17	04.704	146.298	27 10	24.09	206.53	14	9 11	28.640	137.970	21 33	18.11	627.40
15	7 19	31.002	146.242	27 06	57.56	216.16	15	9 13	46.610	137.726	21 22	50.71	634.84
16	7 21	57.244	146.180	27 03	21.40	225.77	16	9 16	04.336	137.482	21 12	15.87	642.22
17	7 24	23.424	146.111	26 59	35.63	235.36	17	9 18	21.818	137.236	21 01	33.65	649.52
18	7 26	49.535	146.036	26 55	40.27	244.93	18	9 20	39.054	136.991	20 50	44.13	656.77
19	7 29	15.571	145.954	26 51	35.34	254.49	19	9 22	56.045	136.745	20 39	47.36	663.93
20	7 31	41.525	145.866	26 47	20.85	264.02	20	9 25	12.790	136.500	20 28	43.43	671.02
21	7 34	07.391	145.771	26 42	56.83	273.53	21	9 27	29.290	136.255	20 17	32.41	678.06
22	7 36	33.162	145.671	26 38	23.30	283.01	22	9 29	45.545	136.009	20 06	14.35	685.02
23	7 38	58.833	145.564	+26 33	40.29	-292.47	23	9 32	01.554	135.765	+19 54	49.33	-691.90
June 11							June 13						
0	7 41	24.397	145.450	+26 28	47.82	-301.90	0	9 34	17.319	135.521	+19 43	17.43	-698.72
1	7 43	49.847	145.332	26 23	45.92	311.30	1	9 36	32.840	135.278	19 31	38.71	705.46
2	7 46	15.179	145.208	26 18	34.62	320.67	2	9 38	48.118	135.034	19 19	53.25	712.13
3	7 48	40.387	145.077	26 13	13.95	330.00	3	9 41	03.152	134.794	19 08	01.12	718.73
4	7 51	05.464	144.941	26 07	43.95	339.31	4	9 43	17.946	134.552	18 56	02.39	725.26
5	7 53	30.405	144.801	26 02	04.64	348.58	5	9 45	32.498	134.313	18 43	57.13	731.71
6	7 55	55.206	144.653	25 56	16.06	357.81	6	9 47	46.811	134.075	18 31	45.42	738.10
7	7 58	19.859	144.502	25 50	18.25	367.01	7	9 50	00.886	133.839	18 19	27.32	744.39
8	8 00	44.361	144.346	25 44	11.24	376.17	8	9 52	14.725	133.603	18 07	02.93	750.64
9	8 03	08.707	144.183	25 37	55.07	385.28	9	9 54	28.328	133.369	17 54	32.29	756.78
10	8 05	32.890	144.017	25 31	29.79	394.36	10	9 56	41.697	133.138	17 41	55.51	762.87
11	8 07	56.907	143.846	25 24	55.43	403.39	11	9 58	54.835	132.907	17 29	12.64	768.88
12	8 10	20.753	143.669	25 18	12.04	412.38	12	10 01	07.742	132.680	17 16	23.76	774.82
13	8 12	44.422	143.490	25 11	19.66	421.33	13	10 03	20.422	132.453	17 03	28.94	780.67
14	8 15	07.912	143.305	25 04	18.33	430.22	14	10 05	32.875	132.229	16 50	28.27	786.45
15	8 17	31.217	143.117	24 57	08.11	439.08	15	10 07	45.104	132.008	16 37	21.82	792.17
16	8 19	54.334	142.924	24 49	49.03	447.88	16	10 09	57.112	131.789	16 24	09.65	797.79
17	8 22	17.258	142.727	24 42	21.15	456.63	17	10 12	08.901	131.572	16 10	51.86	803.35
18	8 24	39.985	142.528	24 34	44.52	465.34	18	10 14	20.473	131.357	15 57	28.51	808.83
19	8 27	02.513	142.323	24 26	59.18	473.99	19	10 16	31.830	131.146	15 43	59.68	814.23
20	8 29	24.836	142.117	24 19	05.19	482.58	20	10 18	42.976	130.938	15 30	25.45	819.56
21	8 31	46.953	141.906	24 11	02.61	491.14	21	10 20	53.914	130.731	15 16	45.89	824.80
22	8 34	08.859	141.693	24 02	51.47	499.63	22	10 23	04.645	130.528	15 03	01.09	829.95
23	8 36	30.552	141.476	23 54	31.84	-508.06	23	10 25	15.173	130.328	14 49	11.10	-835.07
24	8 38	52.028		+23 46	03.78		24	10 27	25.501		+14 35	16.03	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
June 14							June 16						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	10 27 25.501			+ 14 35 16.03		-84.10	0	12 09 01.784			+ 2 12 55.35		-988.10
1	10 29 35.631	130.130		14 21 15.93		845.04	1	12 11 07.320	125.536		1 56 27.25		989.18
2	10 31 45.568	129.937		14 07 10.89		849.91	2	12 13 12.880	125.560		1 39 58.07		990.19
3	10 33 55.315	129.747		13 53 00.98		854.69	3	12 15 18.469	125.589		1 23 27.88		991.10
4	10 36 04.874	129.559		13 38 46.29		859.40	4	12 17 24.092	125.623		1 06 56.78		991.93
5	10 38 14.249	129.375		13 24 26.89		864.04	5	12 19 29.755	125.663		0 50 24.85		992.68
6	10 40 23.444	129.195		13 10 02.85		868.58	6	12 21 35.463	125.708		0 33 52.17		993.34
7	10 42 32.462	129.018		12 55 34.27		873.07	7	12 23 41.222	125.759		0 17 18.83		993.90
8	10 44 41.306	128.844		12 41 01.20		877.47	8	12 25 47.036	125.814		+ 0 00 44.93		994.39
9	10 46 49.982	128.676		12 26 23.73		881.78	9	12 27 52.911	125.875		- 0 15 49.46		994.79
10	10 48 58.491	128.509		12 11 41.95		886.03	10	12 29 58.853	125.942		0 32 24.25		995.10
11	10 51 06.838	128.347		11 56 55.92		890.19	11	12 32 04.867	126.014		0 48 59.35		995.32
12	10 53 15.028	128.190		11 42 05.73		894.28	12	12 34 10.958	126.091		1 05 34.67		995.45
13	10 55 23.063	128.035		11 27 11.45		898.29	13	12 36 17.132	126.174		1 22 10.12		995.50
14	10 57 30.948	127.885		11 12 13.16		902.21	14	12 38 23.394	126.262		1 38 45.62		995.45
15	10 59 38.687	127.739		10 57 10.95		906.07	15	12 40 29.750	126.356		1 55 21.07		995.32
16	11 01 46.285	127.598		10 42 04.88		909.84	16	12 42 36.204	126.454		2 11 56.39		995.09
17	11 03 53.745	127.460		10 26 55.04		913.53	17	12 44 42.763	126.559		2 28 31.48		994.78
18	11 06 01.071	127.326		10 11 41.51		917.14	18	12 46 49.431	126.668		2 45 06.26		994.38
19	11 08 08.268	127.197		9 56 24.37		920.68	19	12 48 56.215	126.784		3 01 40.64		993.88
20	11 10 15.341	127.073		9 41 03.69		924.13	20	12 51 03.119	126.904		3 18 14.52		993.29
21	11 12 22.293	126.952		9 25 39.56		927.51	21	12 53 10.149	127.030		3 34 47.81		992.62
22	11 14 29.129	126.836		9 10 12.05		930.80	22	12 55 17.310	127.161		3 51 20.43		991.84
23	11 16 35.854	126.725		+ 8 54 41.25		-934.02	23	12 57 24.608	127.298		- 4 07 52.27		-990.98
		126.618							127.439				
June 15							June 17						
0	11 18 42.472	126.516		+ 8 39 07.23		-937.16	0	12 59 32.047	127.587		- 4 24 23.25		-990.02
1	11 20 48.988	126.418		8 23 30.07		940.22	1	13 01 39.634	127.739		4 40 53.27		988.98
2	11 22 55.406	126.326		8 07 49.85		943.19	2	13 03 47.373	127.897		4 57 22.25		987.82
3	11 25 01.732	126.237		7 52 06.66		946.09	3	13 05 55.270	128.060		5 13 50.07		986.59
4	11 27 07.969	126.154		7 36 20.57		948.91	4	13 08 03.330	128.228		5 30 16.66		985.26
5	11 29 14.123	126.075		7 20 31.66		951.64	5	13 10 11.558	128.401		5 46 41.92		983.83
6	11 31 20.198	126.002		7 04 40.02		954.30	6	13 12 19.959	128.580		6 03 05.75		982.30
7	11 33 26.200	125.932		6 48 45.72		956.87	7	13 14 28.539	128.764		6 19 28.05		980.68
8	11 35 32.132	125.869		6 32 48.85		959.36	8	13 16 37.303	128.953		6 35 48.73		978.97
9	11 37 38.001	125.809		6 16 49.49		961.78	9	13 18 46.256	129.146		6 52 07.70		977.15
10	11 39 43.810	125.756		6 00 47.71		964.11	10	13 20 55.402	129.346		7 08 24.85		975.24
11	11 41 49.566	125.706		5 44 43.60		966.36	11	13 23 04.748	129.550		7 24 40.09		973.23
12	11 43 55.272	125.663		5 28 37.24		968.53	12	13 25 14.298	129.759		7 40 53.32		971.13
13	11 46 00.935	125.623		5 12 28.71		970.62	13	13 27 24.057	129.973		7 57 04.45		968.91
14	11 48 06.558	125.590		4 56 18.09		972.62	14	13 29 34.030	130.191		8 13 13.36		966.61
15	11 50 12.148	125.561		4 40 05.47		974.54	15	13 31 44.221	130.416		8 29 19.97		964.21
16	11 52 17.709	125.537		4 23 50.93		976.38	16	13 33 54.637	130.644		8 45 24.18		961.70
17	11 54 23.246	125.519		4 07 34.55		978.14	17	13 36 05.281	130.878		9 01 25.88		959.09
18	11 56 28.765	125.506		3 51 16.41		979.81	18	13 38 16.159	131.116		9 17 24.97		956.39
19	11 58 34.271	125.497		3 34 56.60		981.40	19	13 40 27.275	131.359		9 33 21.36		953.58
20	12 00 39.768	125.495		3 18 35.20		982.91	20	13 42 38.634	131.607		9 49 14.94		950.66
21	12 02 45.263	125.497		3 02 12.29		984.33	21	13 44 50.241	131.858		10 05 05.60		947.65
22	12 04 50.760	125.505		2 45 47.96		985.68	22	13 47 02.099	132.115		10 20 53.25		944.54
23	12 06 56.265	125.519		2 29 22.28		-986.93	23	13 49 14.214	132.377		10 36 37.79		-941.32
24	12 09 01.784			+ 2 12 55.35			24	13 51 26.591			- 10 52 19.11		

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
June 18							June 20						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	13	51	26.591	132.641	-10	52 19.11	0	15	43	32.392	148.575	-21	47 23.59
1	13	53	39.232	132.912	11	07 57.10	1	15	46	00.967	148.916	21	58 15.92
2	13	55	52.144	133.185	11	23 31.67	2	15	48	29.883	149.255	22	08 59.71
3	13	58	05.329	133.464	11	39 02.71	3	15	50	59.138	149.590	22	19 34.84
4	14	00	18.793	133.746	11	54 30.11	4	15	53	28.728	149.922	22	30 01.23
5	14	02	32.539	134.032	12	09 53.77	5	15	55	58.650	150.252	22	40 18.78
6	14	04	46.571	134.323	12	25 13.58	6	15	58	28.902	150.578	22	50 27.39
7	14	07	00.894	134.617	12	40 29.45	7	16	00	59.480	150.899	23	00 26.97
8	14	09	15.511	134.915	12	55 41.25	8	16	03	30.379	151.218	23	10 17.42
9	14	11	30.426	135.217	13	10 48.89	9	16	06	01.597	151.531	23	19 58.66
10	14	13	45.643	135.522	13	25 52.26	10	16	08	33.128	151.841	23	29 30.60
11	14	16	01.165	135.831	13	40 51.25	11	16	11	04.969	152.147	23	38 53.14
12	14	18	16.996	136.143	13	55 45.75	12	16	13	37.116	152.447	23	48 06.20
13	14	20	33.139	136.458	14	10 35.66	13	16	16	09.563	152.742	23	57 09.69
14	14	22	49.597	136.778	14	25 20.87	14	16	18	42.305	153.032	24	06 03.53
15	14	25	06.375	137.099	14	40 01.26	15	16	21	15.337	153.317	24	14 47.64
16	14	27	23.474	137.424	14	54 36.74	16	16	23	48.654	153.596	24	23 21.93
17	14	29	40.898	137.752	15	09 07.20	17	16	26	22.250	153.870	24	31 46.33
18	14	31	58.650	138.082	15	23 32.51	18	16	28	56.120	154.137	24	40 00.75
19	14	34	16.732	138.416	15	37 52.59	19	16	31	30.257	154.397	24	48 05.12
20	14	36	35.148	138.751	15	52 07.31	20	16	34	04.654	154.652	24	55 59.37
21	14	38	53.899	139.090	16	06 16.56	21	16	36	39.306	154.900	25	03 43.42
22	14	41	12.989	139.430	16	20 20.24	22	16	39	14.206	155.141	25	11 17.20
23	14	43	32.419	139.772	-16	34 18.25	23	16	41	49.347	155.375	-25	18 40.65
June 19							June 21						
0	14	45	52.191	140.117	-16	48 10.46	0	16	44	24.722	155.602	-25	25 53.69
1	14	48	12.308	140.463	17	01 56.77	1	16	47	00.324	155.820	25	32 56.26
2	14	50	32.771	140.811	17	15 37.06	2	16	49	36.144	156.033	25	39 48.30
3	14	52	53.582	141.161	17	29 11.24	3	16	52	12.177	156.236	25	46 29.75
4	14	55	14.743	141.513	17	42 39.19	4	16	54	48.413	156.431	25	53 00.54
5	14	57	36.256	141.864	17	56 00.81	5	16	57	24.844	156.620	25	59 20.63
6	14	59	58.120	142.218	18	09 15.97	6	17	00	01.464	156.798	26	05 29.96
7	15	02	20.338	142.573	18	22 24.58	7	17	02	38.262	156.969	26	11 28.47
8	15	04	42.911	142.927	18	35 26.52	8	17	05	15.231	157.131	26	17 16.11
9	15	07	05.838	143.284	18	48 21.69	9	17	07	52.362	157.284	26	22 52.84
10	15	09	29.122	143.640	19	01 09.98	10	17	10	29.646	157.428	26	28 18.62
11	15	11	52.762	143.997	19	13 51.27	11	17	13	07.074	157.563	26	33 33.39
12	15	14	16.759	144.353	19	26 25.47	12	17	15	44.637	157.690	26	38 37.12
13	15	16	41.112	144.710	19	38 52.47	13	17	18	22.327	157.805	26	43 29.78
14	15	19	05.822	145.067	19	51 12.15	14	17	21	00.132	157.912	26	48 11.31
15	15	21	30.889	145.422	20	03 24.41	15	17	23	38.044	158.010	26	52 41.70
16	15	23	56.311	145.778	20	15 29.15	16	17	26	16.054	158.097	26	57 00.91
17	15	26	22.089	146.132	20	27 26.25	17	17	28	54.151	158.174	27	01 08.91
18	15	28	48.221	146.486	20	39 15.62	18	17	31	32.325	158.242	27	05 05.68
19	15	31	14.707	146.839	20	50 57.15	19	17	34	10.567	158.299	27	08 51.19
20	15	33	41.546	147.189	21	02 30.74	20	17	36	48.866	158.347	27	12 25.43
21	15	36	08.735	147.539	21	13 56.28	21	17	39	27.213	158.384	27	15 48.37
22	15	38	36.274	147.886	21	25 13.66	22	17	42	05.597	158.411	27	19 00.01
23	15	41	04.160	148.232	21	36 22.80	23	17	44	44.008	158.428	27	22 00.32
24	15	43	32.392		-21	47 23.59	24	17	47	22.436		-27	24 49.29

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
June 22			June 24		
h	m	s	h	m	s
0	17 47 22.436	158.434	0	19 51 09.265	147.414
1	17 50 00.870	158.429	1	19 53 36.679	147.000
2	17 52 39.299	158.415	2	19 56 03.679	146.583
3	17 55 17.714	158.389	3	19 58 30.262	146.161
4	17 57 56.103	158.354	4	20 00 56.423	145.736
5	18 00 34.457	158.308	5	20 03 22.159	145.306
6	18 03 12.765	158.250	6	20 05 47.465	144.873
7	18 05 51.015	158.184	7	20 08 12.338	144.436
8	18 08 29.199	158.105	8	20 10 36.774	143.997
9	18 11 07.304	158.017	9	20 13 00.771	143.554
10	18 13 45.321	157.919	10	20 15 24.325	143.110
11	18 16 23.240	157.809	11	20 17 47.435	142.661
12	18 19 01.049	157.689	12	20 20 10.096	142.211
13	18 21 38.738	157.560	13	20 22 32.307	141.758
14	18 24 16.298	157.419	14	20 24 54.065	141.304
15	18 26 53.717	157.269	15	20 27 15.369	140.848
16	18 29 30.986	157.108	16	20 29 36.217	140.391
17	18 32 08.094	156.938	17	20 31 56.608	139.931
18	18 34 45.032	156.757	18	20 34 16.539	139.470
19	18 37 21.789	156.567	19	20 36 36.009	139.010
20	18 39 58.356	156.366	20	20 38 55.019	138.547
21	18 42 34.722	156.157	21	20 41 13.566	138.084
22	18 45 10.879	155.938	22	20 43 31.650	137.621
23	18 47 46.817	155.709	23	20 45 49.271	137.157
June 23			June 25		
0	18 50 22.526	155.471	0	20 48 06.428	136.694
1	18 52 57.997	155.224	1	20 50 23.122	136.229
2	18 55 33.221	154.968	2	20 52 39.351	135.766
3	18 58 08.189	154.703	3	20 54 55.117	135.303
4	19 00 42.892	154.430	4	20 57 10.420	134.839
5	19 03 17.322	154.148	5	20 59 25.259	134.378
6	19 05 51.470	153.857	6	21 01 39.637	133.916
7	19 08 25.327	153.559	7	21 03 53.553	133.456
8	19 10 58.886	153.253	8	21 06 07.009	132.996
9	19 13 32.139	152.938	9	21 08 20.005	132.538
10	19 16 05.077	152.616	10	21 10 32.543	132.082
11	19 18 37.693	152.286	11	21 12 44.625	131.626
12	19 21 09.979	151.950	12	21 14 56.251	131.173
13	19 23 41.929	151.605	13	21 17 07.424	130.720
14	19 26 13.534	151.255	14	21 19 18.444	130.271
15	19 28 44.789	150.898	15	21 21 28.415	129.823
16	19 31 15.687	150.534	16	21 23 38.238	129.377
17	19 33 46.221	150.163	17	21 25 47.615	128.933
18	19 36 16.384	149.787	18	21 27 56.548	128.492
19	19 38 46.171	149.406	19	21 30 05.040	128.053
20	19 41 15.577	149.017	20	21 32 13.093	127.617
21	19 43 44.594	148.624	21	21 34 20.710	127.183
22	19 46 13.218	148.225	22	21 36 27.893	126.753
23	19 48 41.443	147.822	23	21 38 34.646	126.324
24	19 51 09.265	147.414	24	21 40 40.970	125.894

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
June 26									June 28								
h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
0	21	40	40.970	125.899	-19 05 16.68	0	23	14	33.901	110.131	-9 03 25.53	1	23	16	24.032	109.914	8 49 55.41
1	21	42	46.869	125.477	18 54 04.49	1	23	18	13.946	109.701	8 36 23.89	2	23	20	03.647	109.494	8 22 51.02
2	21	44	52.346	125.058	18 42 47.77	2	23	21	53.141	109.290	8 09 16.85	3	23	23	42.431	109.092	7 55 41.44
3	21	46	57.404	124.643	18 31 26.58	3	23	25	31.523	108.898	7 42 04.81	4	23	27	20.421	108.710	7 28 27.04
4	21	49	02.047	124.229	18 20 01.01	4	23	29	09.131	108.526	7 14 48.16	5	23	30	57.657	108.347	7 01 08.22
5	21	51	06.276	123.821	18 08 31.15	5	23	32	46.004	108.173	6 47 27.27	6	23	34	34.177	108.004	6 33 45.35
6	21	53	10.097	123.415	17 56 57.06	6	23	36	22.181	107.839	6 20 02.51	7	23	38	10.020	107.680	6 06 18.80
7	21	55	13.512	123.013	17 45 18.84	7	23	39	57.700	107.525	5 52 34.26	8	23	41	45.225	107.374	5 38 48.94
8	21	57	16.525	122.614	17 33 36.55	8	23	43	32.599	107.230	5 25 02.87	9	23	45	19.829	107.089	5 11 16.11
9	21	59	19.139	122.220	17 21 50.28	9	23	47	06.918	106.953	4 57 28.70	10	23	48	53.871	106.823	4 43 40.67
10	22	01	21.359	121.828	17 10 00.10	10	23	50	40.694	106.697	4 29 52.09	11	23	52	27.391	106.575	4 16 02.98
11	22	03	23.187	121.440	16 58 06.09	11	23	54	13.966	106.460	4 02 13.38	12	23	56	00.426	106.348	-3 48 23.35
12	22	05	24.627	121.057	16 46 08.32	12											
13	22	07	25.684	120.677	16 34 06.87	13											
14	22	09	26.361	120.302	16 22 01.82	14											
15	22	11	26.663	119.929	16 09 53.23	15											
16	22	13	26.592	119.562	15 57 41.18	16											
17	22	15	26.154	119.198	15 45 25.75	17											
18	22	17	25.352	118.838	15 33 06.99	18											
19	22	19	24.190	118.483	15 20 44.99	19											
20	22	21	22.673	118.132	15 08 19.81	20											
21	22	23	20.805	117.785	14 55 51.52	21											
22	22	25	18.590	117.442	14 43 20.19	22											
23	22	27	16.032	117.103	-14 30 45.89	23											
June 27									June 29								
0	22	29	13.135	116.770	-14 18 08.68	0	23	57	46.774	106.241	-3 34 32.93	1	23	59	33.015	106.139	3 20 42.15
1	22	31	09.905	116.441	14 05 28.63	1	0	01	19.154	106.042	3 06 51.05	2	0	03	05.196	105.950	2 52 59.68
2	22	33	06.346	116.115	13 52 45.80	2	0	04	51.146	105.862	2 39 08.08	3	0	06	37.008	105.779	2 25 16.29
3	22	35	02.461	115.795	13 40 00.27	3	0	08	22.787	105.701	2 11 24.35	4	0	10	08.488	105.628	1 57 32.29
4	22	36	58.256	115.478	13 27 12.09	4	0	11	54.116	105.559	1 43 40.17	5	0	13	39.675	105.496	1 29 48.01
5	22	38	53.734	115.167	13 14 21.33	5	0	15	25.171	105.437	1 15 55.86	6	0	17	10.608	105.382	1 02 03.76
6	22	40	48.901	114.860	13 01 28.04	6	0	18	55.990	105.333	0 48 11.75	7	0	20	41.323	105.288	0 34 19.86
7	22	42	43.761	114.557	12 48 32.30	7	0	22	26.611	105.248	0 20 28.13	8	0	24	11.859	105.213	-0 06 36.61
8	22	44	38.318	114.260	12 35 34.16	8	0	25	57.072	105.182	+0 07 14.67	9	0	27	42.254	105.156	+0 01 05.67
9	22	46	32.578	113.966	12 22 33.69	9	0	29	27.410	105.135	0 34 56.35	10	0	31	12.545	105.119	0 48 46.67
10	22	48	26.544	113.678	12 09 30.94	10	0	32	57.664	105.106	1 02 36.59	11	0	34	42.770	105.100	1 16 26.08
11	22	50	20.222	113.393	11 56 25.97	11	0	36	27.870	105.097	1 30 15.10	12	0	38	12.967	105.100	1 44 03.61
12	22	52	13.615	113.115	11 43 18.85	12	0	39	58.067		+1 57 51.57	13					
13	22	54	06.730	112.839	11 30 09.62	13											
14	22	55	59.569	112.570	11 16 58.35	14											
15	22	57	52.139	112.305	11 03 45.10	15											
16	22	59	44.444	112.044	10 50 29.92	16											
17	23	01	36.488	111.788	10 37 12.86	17											
18	23	03	28.276	111.537	10 23 53.98	18											
19	23	05	19.813	111.291	10 10 33.34	19											
20	23	07	11.104	111.049	9 57 10.99	20											
21	23	09	02.153	110.813	9 43 46.98	21											
22	23	10	52.966	110.581	9 30 21.36	22											
23	23	12	43.547	110.354	9 16 54.20	23											
24	23	14	33.901		-9 03 25.53	24											

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
June 30			July 2		
h	h m s	° ' "	h	h m s	° ' "
0	0 39 58.067 ^s	+ 1 57 51.57 ["]	0	2 05 35.394 ^s	+12 36 41.28 ["]
1	0 41 43.173 ^s	2 11 38.94 ["]	1	2 07 26.174 ^s	12 49 13.52 ["]
2	0 43 28.291 ^s	2 25 25.69 ["]	2	2 09 17.179 ^s	13 01 43.12 ["]
3	0 45 13.426 ^s	2 39 11.77 ["]	3	2 11 08.413 ^s	13 14 10.04 ["]
4	0 46 58.581 ^s	2 52 57.15 ["]	4	2 12 59.880 ^s	13 26 34.23 ["]
5	0 48 43.762 ^s	3 06 41.79 ["]	5	2 14 51.583 ^s	13 38 55.63 ["]
6	0 50 28.973 ^s	3 20 25.66 ["]	6	2 16 43.528 ^s	13 51 14.20 ["]
7	0 52 14.219 ^s	3 34 08.70 ["]	7	2 18 35.718 ^s	14 03 29.88 ["]
8	0 53 59.504 ^s	3 47 50.90 ["]	8	2 20 28.157 ^s	14 15 42.63 ["]
9	0 55 44.834 ^s	4 01 32.20 ["]	9	2 22 20.849 ^s	14 27 52.39 ["]
10	0 57 30.212 ^s	4 15 12.57 ["]	10	2 24 13.797 ^s	14 39 59.11 ["]
11	0 59 15.643 ^s	4 28 51.96 ["]	11	2 26 07.006 ^s	14 52 02.74 ["]
12	1 01 01.133 ^s	4 42 30.36 ["]	12	2 28 00.480 ^s	15 04 03.22 ["]
13	1 02 46.684 ^s	4 56 07.70 ["]	13	2 29 54.221 ^s	15 16 00.50 ["]
14	1 04 32.303 ^s	5 09 43.96 ["]	14	2 31 48.235 ^s	15 27 54.53 ["]
15	1 06 17.994 ^s	5 23 19.09 ["]	15	2 33 42.524 ^s	15 39 45.25 ["]
16	1 08 03.761 ^s	5 36 53.06 ["]	16	2 35 37.093 ^s	15 51 32.61 ["]
17	1 09 49.608 ^s	5 50 25.82 ["]	17	2 37 31.945 ^s	16 03 16.55 ["]
18	1 11 35.541 ^s	6 03 57.35 ["]	18	2 39 27.083 ^s	16 14 57.02 ["]
19	1 13 21.564 ^s	6 17 27.59 ["]	19	2 41 22.511 ^s	16 26 33.96 ["]
20	1 15 07.681 ^s	6 30 56.51 ["]	20	2 43 18.233 ^s	16 38 07.31 ["]
21	1 16 53.897 ^s	6 44 24.07 ["]	21	2 45 14.252 ^s	16 49 37.02 ["]
22	1 18 40.217 ^s	6 57 50.22 ["]	22	2 47 10.571 ^s	17 01 03.02 ["]
23	1 20 26.645 ^s	+ 7 11 14.94 ["]	23	2 49 07.194 ^s	+17 12 25.26 ["]
		+803.23			+678.43
July 1			July 3		
0	1 22 13.185 ^s	+ 7 24 38.17 ["]	0	2 51 04.124 ^s	+17 23 43.69 ["]
1	1 23 59.842 ^s	7 37 59.88 ["]	1	2 53 01.365 ^s	17 34 58.23 ["]
2	1 25 46.620 ^s	7 51 20.02 ["]	2	2 54 58.919 ^s	17 46 08.84 ["]
3	1 27 33.525 ^s	8 04 38.56 ["]	3	2 56 56.790 ^s	17 57 15.45 ["]
4	1 29 20.560 ^s	8 17 55.45 ["]	4	2 58 54.981 ^s	18 08 18.00 ["]
5	1 31 07.729 ^s	8 31 10.66 ["]	5	3 00 53.495 ^s	18 19 16.44 ["]
6	1 32 55.038 ^s	8 44 24.13 ["]	6	3 02 52.334 ^s	18 30 10.69 ["]
7	1 34 42.491 ^s	8 57 35.83 ["]	7	3 04 51.503 ^s	18 41 00.69 ["]
8	1 36 30.092 ^s	9 10 45.72 ["]	8	3 06 51.003 ^s	18 51 46.39 ["]
9	1 38 17.845 ^s	9 23 53.75 ["]	9	3 08 50.837 ^s	19 02 27.72 ["]
10	1 40 05.755 ^s	9 36 59.88 ["]	10	3 10 51.009 ^s	19 13 04.62 ["]
11	1 41 53.827 ^s	9 50 04.06 ["]	11	3 12 51.521 ^s	19 23 37.03 ["]
12	1 43 42.064 ^s	10 03 06.26 ["]	12	3 14 52.374 ^s	19 34 04.87 ["]
13	1 45 30.471 ^s	10 16 06.43 ["]	13	3 16 53.573 ^s	19 44 28.09 ["]
14	1 47 19.052 ^s	10 29 04.52 ["]	14	3 18 55.119 ^s	19 54 46.61 ["]
15	1 49 07.812 ^s	10 42 00.49 ["]	15	3 20 57.015 ^s	20 05 00.38 ["]
16	1 50 56.755 ^s	10 54 54.29 ["]	16	3 22 59.262 ^s	20 15 09.33 ["]
17	1 52 45.885 ^s	11 07 45.89 ["]	17	3 25 01.864 ^s	20 25 13.39 ["]
18	1 54 35.207 ^s	11 20 35.23 ["]	18	3 27 04.822 ^s	20 35 12.49 ["]
19	1 56 24.724 ^s	11 33 22.27 ["]	19	3 29 08.139 ^s	20 45 06.57 ["]
20	1 58 14.442 ^s	11 46 06.95 ["]	20	3 31 11.815 ^s	20 54 55.56 ["]
21	2 00 04.363 ^s	11 58 49.25 ["]	21	3 33 15.854 ^s	21 04 39.39 ["]
22	2 01 54.493 ^s	12 11 29.10 ["]	22	3 35 20.256 ^s	21 14 18.00 ["]
23	2 03 44.835 ^s	12 24 06.46 ["]	23	3 37 25.024 ^s	21 23 51.31 ["]
24	2 05 35.394 ^s	+12 36 41.28 ["]	24	3 39 30.159 ^s	+21 33 19.25 ["]
		+754.82			+567.94

MOON, 1967

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
July 4									July 6								
h	h	m	s	s	°	'	"	"	h	h	m	s	s	°	'	"	"
0	3 39	30	159	125.504	+21	33	19.25	+562.51	0	5 26	49	964	142.529	+26	59	16.89	+218.26
1	3 41	35	663	125.873	21	42	41.76	557.01	1	5 29	12	493	142.812	27	02	55.15	209.45
2	3 43	41	536	126.245	21	51	58.77	551.43	2	5 31	35	305	143.091	27	06	24.60	200.57
3	3 45	47	781	126.617	22	01	10.20	545.79	3	5 33	58	396	143.364	27	09	45.17	191.64
4	3 47	54	398	126.990	22	10	15.99	540.08	4	5 36	21	760	143.631	27	12	56.81	182.66
5	3 50	01	388	127.365	22	19	16.07	534.29	5	5 38	45	391	143.893	27	15	59.47	173.62
6	3 52	08	753	127.740	22	28	10.36	528.43	6	5 41	09	284	144.148	27	18	53.09	164.52
7	3 54	16	493	128.116	22	36	58.79	522.51	7	5 43	33	432	144.399	27	21	37.61	155.39
8	3 56	24	609	128.492	22	45	41.30	516.50	8	5 45	57	831	144.641	27	24	13.00	146.19
9	3 58	33	101	128.870	22	54	17.80	510.44	9	5 48	22	472	144.880	27	26	39.19	136.94
10	4 00	41	971	129.246	23	02	48.24	504.29	10	5 50	47	352	145.110	27	28	56.13	127.66
11	4 02	51	217	129.625	23	11	12.53	498.07	11	5 53	12	462	145.335	27	31	03.79	118.32
12	4 05	00	842	130.002	23	19	30.60	491.79	12	5 55	37	797	145.553	27	33	02.11	108.94
13	4 07	10	844	130.381	23	27	42.39	485.43	13	5 58	03	350	145.765	27	34	51.05	99.51
14	4 09	21	225	130.757	23	35	47.82	479.00	14	6 00	29	115	145.969	27	36	30.56	90.05
15	4 11	31	982	131.136	23	43	46.82	472.49	15	6 02	55	084	146.166	27	38	00.61	80.53
16	4 13	43	118	131.512	23	51	39.31	465.91	16	6 05	21	250	146.358	27	39	21.14	70.99
17	4 15	54	630	131.889	23	59	25.22	459.27	17	6 07	47	608	146.541	27	40	32.13	61.40
18	4 18	06	519	132.265	24	07	04.49	452.54	18	6 10	14	149	146.717	27	41	33.53	51.78
19	4 20	18	784	132.640	24	14	37.03	445.75	19	6 12	40	866	146.886	27	42	25.31	42.12
20	4 22	31	424	133.014	24	22	02.78	438.88	20	6 15	07	752	147.049	27	43	07.43	32.43
21	4 24	44	438	133.388	24	29	21.66	431.94	21	6 17	34	801	147.203	27	43	39.86	22.70
22	4 26	57	826	133.759	24	36	33.60	424.93	22	6 20	02	004	147.349	27	44	02.56	12.95
23	4 29	11	585	134.130	+24	43	38.53	+417.85	23	6 22	29	353	147.490	+27	44	15.51	+3.16
July 5									July 7								
0	4 31	25	715	134.499	+24	50	36.38	+410.69	0	6 24	56	843	147.621	+27	44	18.67	-6.64
1	4 33	40	214	134.867	24	57	27.07	403.46	1	6 27	24	464	147.745	27	44	12.03	16.48
2	4 35	55	081	135.232	25	04	10.53	396.16	2	6 29	52	209	147.862	27	43	55.55	26.34
3	4 38	10	313	135.597	25	10	46.69	388.79	3	6 32	20	071	147.971	27	43	29.21	36.22
4	4 40	25	910	135.958	25	17	15.48	381.35	4	6 34	48	042	148.071	27	42	52.99	46.13
5	4 42	41	868	136.317	25	23	36.83	373.84	5	6 37	16	113	148.165	27	42	06.86	56.04
6	4 44	58	185	136.675	25	29	50.67	366.25	6	6 39	44	278	148.250	27	41	10.82	65.98
7	4 47	14	860	137.030	25	35	56.92	358.60	7	6 42	12	528	148.328	27	40	04.84	75.93
8	4 49	31	890	137.381	25	41	55.52	350.87	8	6 44	40	856	148.397	27	38	48.91	85.90
9	4 51	49	271	137.731	25	47	46.39	343.09	9	6 47	09	253	148.458	27	37	23.01	95.87
10	4 54	07	002	138.077	25	53	29.48	335.22	10	6 49	37	711	148.513	27	35	47.14	105.87
11	4 56	25	079	138.420	25	59	04.70	327.29	11	6 52	06	224	148.558	27	34	01.27	115.85
12	4 58	43	499	138.760	26	04	31.99	319.30	12	6 54	34	782	148.596	27	32	05.42	125.86
13	5 01	02	259	139.097	26	09	51.29	311.23	13	6 57	03	378	148.626	27	29	59.56	135.86
14	5 03	21	356	139.429	26	15	02.52	303.09	14	6 59	32	004	148.648	27	27	43.70	145.87
15	5 05	40	785	139.759	26	20	05.61	294.90	15	7 02	00	652	148.662	27	25	17.83	155.88
16	5 08	00	544	140.083	26	25	00.51	286.64	16	7 04	29	314	148.669	27	22	41.95	165.88
17	5 10	20	627	140.405	26	29	47.15	278.31	17	7 06	57	983	148.668	27	19	56.07	175.89
18	5 12	41	032	140.722	26	34	25.46	269.91	18	7 09	26	651	148.658	27	17	00.18	185.89
19	5 15	01	754	141.035	26	38	55.37	261.46	19	7 11	55	309	148.641	27	13	54.29	195.88
20	5 17	22	789	141.343	26	43	16.83	252.95	20	7 14	23	950	148.617	27	10	38.41	205.86
21	5 19	44	132	141.647	26	47	29.78	244.36	21	7 16	52	567	148.585	27	07	12.55	215.84
22	5 22	05	779	141.946	26	51	34.14	235.72	22	7 19	21	152	148.545	27	03	36.71	225.80
23	5 24	27	725	142.239	26	55	29.86	+227.03	23	7 21	49	697	148.497	26	59	50.91	-235.75
24	5 26	49	964		+26	59	16.89		24	7 24	18	194		+26	55	55.16	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
July 8			July 10		
h	h m s	° ' "	h	h m s	° ' "
0	7 24 18.194 ^s	+26 55 55.16	0	9 20 09.418 ^s	+20 43 49.88
1	7 26 46.637 ^s	26 51 49.49	1	9 22 28.733 ^s	20 32 37.23
2	7 29 15.018 ^s	26 47 33.89	2	9 24 47.781 ^s	20 21 17.26
3	7 31 43.329 ^s	26 43 08.40	3	9 27 06.561 ^s	20 09 50.03
4	7 34 11.564 ^s	26 38 33.04	4	9 29 25.073 ^s	19 58 15.62
5	7 36 39.715 ^s	26 33 47.83	5	9 31 43.318 ^s	19 46 34.13
6	7 39 07.775 ^s	26 28 52.79	6	9 34 01.294 ^s	19 34 45.62
7	7 41 35.738 ^s	26 23 47.95	7	9 36 19.001 ^s	19 22 50.19
8	7 44 03.596 ^s	26 18 33.34	8	9 38 36.441 ^s	19 10 47.91
9	7 46 31.343 ^s	26 13 08.99	9	9 40 53.613 ^s	18 58 38.86
10	7 48 58.972 ^s	26 07 34.93	10	9 43 10.517 ^s	18 46 23.13
11	7 51 26.476 ^s	26 01 51.19	11	9 45 27.154 ^s	18 34 00.80
12	7 53 53.850 ^s	25 55 57.81	12	9 47 43.526 ^s	18 21 31.96
13	7 56 21.086 ^s	25 49 54.83	13	9 49 59.632 ^s	18 08 56.69
14	7 58 48.179 ^s	25 43 42.27	14	9 52 15.473 ^s	17 56 15.08
15	8 01 15.123 ^s	25 37 20.19	15	9 54 31.051 ^s	17 43 27.20
16	8 03 41.911 ^s	25 30 48.62	16	9 56 46.368 ^s	17 30 33.15
17	8 06 08.539 ^s	25 24 07.61	17	9 59 01.423 ^s	17 17 33.00
18	8 08 35.000 ^s	25 17 17.20	18	10 01 16.219 ^s	17 04 26.86
19	8 11 01.289 ^s	25 10 17.44	19	10 03 30.758 ^s	16 51 14.79
20	8 13 27.400 ^s	25 03 08.37	20	10 05 45.040 ^s	16 37 56.89
21	8 15 53.329 ^s	24 55 50.05	21	10 07 59.069 ^s	16 24 33.25
22	8 18 19.069 ^s	24 48 22.52	22	10 10 12.845 ^s	16 11 03.95
23	8 20 44.617 ^s	+24 40 45.83	23	10 12 26.370 ^s	+15 57 29.07
	145.351	-465.79		133.278	-820.36
July 9			July 11		
h	h m s	° ' "	h	h m s	° ' "
0	8 23 09.968 ^s	+24 33 00.04	0	10 14 39.648 ^s	+15 43 48.71
1	8 25 35.116 ^s	24 25 05.20	1	10 16 52.680 ^s	15 30 02.96
2	8 28 00.058 ^s	24 17 01.37	2	10 19 05.468 ^s	15 16 11.89
3	8 30 24.789 ^s	24 08 48.61	3	10 21 18.015 ^s	15 02 15.60
4	8 32 49.305 ^s	24 00 26.97	4	10 23 30.324 ^s	14 48 14.17
5	8 35 13.601 ^s	23 51 56.51	5	10 25 42.396 ^s	14 34 07.70
6	8 37 37.675 ^s	23 43 17.30	6	10 27 54.236 ^s	14 19 56.26
7	8 40 01.522 ^s	23 34 29.39	7	10 30 05.845 ^s	14 05 39.95
8	8 42 25.138 ^s	23 25 32.86	8	10 32 17.227 ^s	13 51 18.86
9	8 44 48.521 ^s	23 16 27.75	9	10 34 28.385 ^s	13 36 53.07
10	8 47 11.667 ^s	23 07 14.14	10	10 36 39.321 ^s	13 22 22.67
11	8 49 34.574 ^s	22 57 52.10	11	10 38 50.040 ^s	13 07 47.74
12	8 51 57.237 ^s	22 48 21.69	12	10 41 00.543 ^s	12 53 08.39
13	8 54 19.655 ^s	22 38 42.98	13	10 43 10.836 ^s	12 38 24.69
14	8 56 41.825 ^s	22 28 56.04	14	10 45 20.920 ^s	12 23 36.73
15	8 59 03.744 ^s	22 19 00.94	15	10 47 30.800 ^s	12 08 44.60
16	9 01 25.410 ^s	22 08 57.75	16	10 49 40.478 ^s	11 53 48.39
17	9 03 46.821 ^s	21 58 46.55	17	10 51 49.960 ^s	11 38 48.19
18	9 06 07.976 ^s	21 48 27.40	18	10 53 59.248 ^s	11 23 44.08
19	9 08 28.872 ^s	21 38 00.38	19	10 56 08.347 ^s	11 08 36.15
20	9 10 49.507 ^s	21 27 25.57	20	10 58 17.259 ^s	10 53 24.50
21	9 13 09.881 ^s	21 16 43.03	21	11 00 25.990 ^s	10 38 09.20
22	9 15 29.991 ^s	21 05 52.85	22	11 02 34.543 ^s	10 22 50.34
23	9 17 49.837 ^s	20 54 55.11	23	11 04 42.922 ^s	10 07 28.02
24	9 20 09.418 ^s	+20 43 49.88	24	11 06 51.131 ^s	+9 52 02.32
	139.581	-665.23		128.209	-925.70

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
July 12			July 14		
h	h m s	° ' "	h	h m s	° ' "
0	11 06 51.131 ^s	+ 9 52 02.32 ["]	0	12 47 37.214 ^s	- 3 06 24.58 ["]
1	11 08 59.175	9 36 33.32	1	12 49 42.986	3 22 49.77
2	11 11 07.057	9 21 01.13	2	12 51 48.838	3 39 14.03
3	11 13 14.782	9 05 25.81	3	12 53 54.776	3 55 37.25
4	11 15 22.355	8 49 47.47	4	12 56 00.803	4 11 59.36
5	11 17 29.779	8 34 06.18	5	12 58 06.927	4 28 20.26
6	11 19 37.060	8 18 22.03	6	13 00 13.151	4 44 39.87
7	11 21 44.201	8 02 35.12	7	13 02 19.482	5 00 58.10
8	11 23 51.207	7 46 45.53	8	13 04 25.924	5 17 14.87
9	11 25 58.083	7 30 53.34	9	13 06 32.483	5 33 30.08
10	11 28 04.834	7 14 58.65	10	13 08 39.163	5 49 43.65
11	11 30 11.463	6 59 01.54	11	13 10 45.971	6 05 55.49
12	11 32 17.976	6 43 02.09	12	13 12 52.911	6 22 05.51
13	11 34 24.378	6 27 00.39	13	13 14 59.989	6 38 13.62
14	11 36 30.673	6 10 56.54	14	13 17 07.208	6 54 19.74
15	11 38 36.866	5 54 50.61	15	13 19 14.576	7 10 23.78
16	11 40 42.963	5 38 42.69	16	13 21 22.096	7 26 25.64
17	11 42 48.967	5 22 32.88	17	13 23 29.774	7 42 25.24
18	11 44 54.883	5 06 21.24	18	13 25 37.614	7 58 22.49
19	11 47 00.718	4 50 07.88	19	13 27 45.623	8 14 17.30
20	11 49 06.475	4 33 52.88	20	13 29 53.804	8 30 09.58
21	11 51 12.160	4 17 36.32	21	13 32 02.162	8 45 59.23
22	11 53 17.778	4 01 18.30	22	13 34 10.703	9 01 46.18
23	11 55 23.333	+ 3 44 58.88	23	13 36 19.431	- 9 17 30.33
	125.499	-980.70		128.920	-941.25
July 13			July 15		
0	11 57 28.832	+ 3 28 38.18	0	13 38 28.351	- 9 33 11.58
1	11 59 34.278	3 12 16.25	1	13 40 37.468	9 48 49.86
2	12 01 39.678	2 55 53.21	2	13 42 46.787	10 04 25.06
3	12 03 45.036	2 39 29.12	3	13 44 56.312	10 19 57.10
4	12 05 50.358	2 23 04.08	4	13 47 06.047	10 35 25.88
5	12 07 55.648	2 06 38.18	5	13 49 15.998	10 50 51.32
6	12 10 00.912	1 50 11.49	6	13 51 26.169	11 06 13.32
7	12 12 06.155	1 33 44.10	7	13 53 36.564	11 21 31.79
8	12 14 11.383	1 17 16.11	8	13 55 47.188	11 36 46.64
9	12 16 16.600	1 00 47.59	9	13 57 58.046	11 51 57.77
10	12 18 21.812	0 44 18.63	10	14 00 09.140	12 07 05.10
11	12 20 27.025	0 27 49.32	11	14 02 20.476	12 22 08.53
12	12 22 32.242	+ 0 11 19.75	12	14 04 32.058	12 37 07.96
13	12 24 37.471	- 0 05 10.01	13	14 06 43.890	12 52 03.32
14	12 26 42.716	0 21 39.86	14	14 08 55.976	13 06 54.49
15	12 28 47.981	0 38 09.72	15	14 11 08.320	13 21 41.39
16	12 30 53.274	0 54 39.50	16	14 13 20.925	13 36 23.93
17	12 32 58.599	1 11 09.11	17	14 15 33.796	13 51 02.00
18	12 35 03.961	1 27 38.48	18	14 17 46.936	14 05 35.53
19	12 37 09.365	1 44 07.51	19	14 20 00.349	14 20 04.40
20	12 39 14.818	2 00 36.11	20	14 22 14.038	14 34 28.54
21	12 41 20.324	2 17 04.21	21	14 24 28.008	14 48 47.84
22	12 43 25.888	2 33 31.71	22	14 26 42.260	15 03 02.21
23	12 45 31.517	2 49 58.53	23	14 28 56.800	15 17 11.55
24	12 47 37.214	- 3 06 24.58	24	14 31 11.629	-844.23
	125.697	-986.05		134.829	

MOON, 1967

FOR EACH HOUR OF EPHEMERIS TIME

117

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
July 16			July 18		
h	h m s	° ' "	h	h m s	° ' "
0	14 31 11.629	135.121	0	16 25 15.491	150.193
1	14 33 26.750	135.418	1	16 27 45.684	150.461
2	14 35 42.168	135.716	2	16 30 16.145	150.723
3	14 37 57.884	136.018	3	16 32 46.868	150.981
4	14 40 13.902	136.322	4	16 35 17.849	151.234
5	14 42 30.224	136.628	5	16 37 49.083	151.480
6	14 44 46.852	136.938	6	16 40 20.563	151.721
7	14 47 03.790	137.249	7	16 42 52.284	151.956
8	14 49 21.039	137.563	8	16 45 24.240	152.185
9	14 51 38.602	137.879	9	16 47 56.425	152.408
10	14 53 56.481	138.196	10	16 50 28.833	152.624
11	14 56 14.677	138.516	11	16 53 01.457	152.834
12	14 58 33.193	138.837	12	16 55 34.291	153.036
13	15 00 52.030	139.160	13	16 58 07.327	153.232
14	15 03 11.190	139.484	14	17 00 40.559	153.421
15	15 05 30.674	139.809	15	17 03 13.980	153.602
16	15 07 50.483	140.136	16	17 05 47.582	153.776
17	15 10 10.619	140.464	17	17 08 21.358	153.942
18	15 12 31.083	140.792	18	17 10 55.300	154.100
19	15 14 51.875	141.121	19	17 13 29.400	154.251
20	15 17 12.996	141.451	20	17 16 03.651	154.394
21	15 19 34.447	141.781	21	17 18 38.045	154.528
22	15 21 56.228	142.111	22	17 21 12.573	154.654
23	15 24 18.339	142.441	23	17 23 47.227	154.771
July 17			July 19		
0	15 26 40.780	142.772	0	17 26 21.998	154.880
1	15 29 03.552	143.101	1	17 28 56.878	154.981
2	15 31 26.653	143.430	2	17 31 31.859	155.073
3	15 33 50.083	143.760	3	17 34 06.932	155.155
4	15 36 13.843	144.087	4	17 36 42.087	155.228
5	15 38 37.930	144.415	5	17 39 17.315	155.294
6	15 41 02.345	144.740	6	17 41 52.609	155.348
7	15 43 27.085	145.065	7	17 44 27.957	155.396
8	15 45 52.150	145.387	8	17 47 03.353	155.432
9	15 48 17.537	145.709	9	17 49 38.785	155.459
10	15 50 43.246	146.028	10	17 52 14.244	155.478
11	15 53 09.274	146.346	11	17 54 49.722	155.487
12	15 55 35.620	146.660	12	17 57 25.209	155.486
13	15 58 02.280	146.973	13	18 00 00.695	155.476
14	16 00 29.253	147.283	14	18 02 36.171	155.456
15	16 02 56.536	147.590	15	18 05 11.627	155.426
16	16 05 24.126	147.894	16	18 07 47.053	155.388
17	16 07 52.020	148.194	17	18 10 22.441	155.339
18	16 10 20.214	148.492	18	18 12 57.780	155.281
19	16 12 48.706	148.786	19	18 15 33.061	155.213
20	16 15 17.492	149.075	20	18 18 08.274	155.135
21	16 17 46.567	149.361	21	18 20 43.409	155.049
22	16 20 15.928	149.643	22	18 23 18.458	154.953
23	16 22 45.571	149.920	23	18 25 53.411	154.846
24	16 25 15.491	149.920	24	18 28 28.257	154.721

MOON, 1967
FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
July 20							July 22						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	18	28	28.257	154.731	-27	45 45.30	0	20	27	34.887	140.316	-24	17 02.00
1	18	31	02.988	154.607	27	45 19.60	1	20	29	55.203	139.895	24	09 02.16
2	18	33	37.595	154.472	27	44 43.13	2	20	32	15.098	139.474	24	00 54.73
3	18	36	12.067	154.329	27	43 55.94	3	20	34	34.572	139.049	23	52 39.80
4	18	38	46.396	154.177	27	42 58.04	4	20	36	53.621	138.624	23	44 17.47
5	18	41	20.573	154.014	27	41 49.48	5	20	39	12.245	138.198	23	35 47.82
6	18	43	54.587	153.845	27	40 30.28	6	20	41	30.443	137.770	23	27 10.94
7	18	46	28.432	153.664	27	39 00.48	7	20	43	48.213	137.341	23	18 26.93
8	18	49	02.096	153.476	27	37 20.12	8	20	46	05.554	136.911	23	09 35.87
9	18	51	35.572	153.278	27	35 29.24	9	20	48	22.465	136.481	23	00 37.86
10	18	54	08.850	153.073	27	33 27.89	10	20	50	38.946	136.049	22	51 32.99
11	18	56	41.923	152.858	27	31 16.10	11	20	52	54.995	135.619	22	42 21.35
12	18	59	14.781	152.635	27	28 53.92	12	20	55	10.614	135.186	22	33 03.02
13	19	01	47.416	152.404	27	26 21.40	13	20	57	25.800	134.755	22	23 38.11
14	19	04	19.820	152.165	27	23 38.60	14	20	59	40.555	134.323	22	14 06.69
15	19	06	51.985	151.917	27	20 45.55	15	21	01	54.878	133.892	22	04 28.87
16	19	09	23.902	151.662	27	17 42.33	16	21	04	08.770	133.460	21	54 44.73
17	19	11	55.564	151.398	27	14 28.97	17	21	06	22.230	133.030	21	44 54.37
18	19	14	26.962	151.128	27	11 05.55	18	21	08	35.260	132.599	21	34 57.87
19	19	16	58.090	150.851	27	07 32.11	19	21	10	47.859	132.171	21	24 55.32
20	19	19	28.941	150.564	27	03 48.72	20	21	13	00.030	131.742	21	14 46.82
21	19	21	59.505	150.272	26	59 55.44	21	21	15	11.772	131.315	21	04 32.45
22	19	24	29.777	149.973	26	55 52.33	22	21	17	23.087	130.888	20	54 12.30
23	19	26	59.750	149.666	-26	51 39.46	23	21	19	33.975	130.464	-20	43 46.46
July 21							July 23						
0	19	29	29.416	149.353	-26	47 16.90	0	21	21	44.439	130.040	-20	33 15.03
1	19	31	58.769	149.034	26	42 44.71	1	21	23	54.479	129.618	20	22 38.09
2	19	34	27.803	148.708	26	38 02.97	2	21	26	04.097	129.198	20	11 55.72
3	19	36	56.511	148.376	26	33 11.74	3	21	28	13.295	128.780	20	01 08.02
4	19	39	24.887	148.038	26	28 11.09	4	21	30	22.075	128.362	19	50 15.07
5	19	41	52.925	147.694	26	23 01.10	5	21	32	30.437	127.948	19	39 16.96
6	19	44	20.619	147.345	26	17 41.85	6	21	34	38.385	127.535	19	28 13.77
7	19	46	47.964	146.991	26	12 13.41	7	21	36	45.920	127.125	19	17 05.60
8	19	49	14.955	146.631	26	06 35.86	8	21	38	53.045	126.716	19	05 52.52
9	19	51	41.586	146.266	26	00 49.27	9	21	40	59.761	126.311	18	54 34.62
10	19	54	07.852	145.896	25	54 53.72	10	21	43	06.072	125.907	18	43 11.99
11	19	56	33.748	145.522	25	48 49.30	11	21	45	11.979	125.506	18	31 44.71
12	19	58	59.270	145.143	25	42 36.08	12	21	47	17.485	125.108	18	20 12.87
13	20	01	24.413	144.760	25	36 14.15	13	21	49	22.593	124.713	18	08 36.54
14	20	03	49.173	144.372	25	29 43.59	14	21	51	27.306	124.320	17	56 55.81
15	20	06	13.545	143.982	25	23 04.48	15	21	53	31.626	123.930	17	45 10.76
16	20	08	37.527	143.586	25	16 16.91	16	21	55	35.556	123.543	17	33 21.47
17	20	11	01.113	143.188	25	09 20.96	17	21	57	39.099	123.159	17	21 28.03
18	20	13	24.301	142.786	25	02 16.71	18	21	59	42.258	122.779	17	09 30.51
19	20	15	47.087	142.382	24	55 04.27	19	22	01	45.037	122.401	16	57 28.99
20	20	18	09.469	141.973	24	47 43.70	20	22	03	47.438	122.027	16	45 23.55
21	20	20	31.442	141.563	24	40 15.10	21	22	05	49.465	121.657	16	33 14.27
22	20	22	53.005	141.149	24	32 38.56	22	22	07	51.122	121.288	16	21 01.23
23	20	25	14.154	140.733	24	24 54.16	23	22	09	52.410	120.925	16	08 44.50
24	20	27	34.887		-24	17 02.00	24	22	11	53.335		-15	56 24.16

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
July 24			July 26		
h	h m s	° ' "	h	h m s	° ' "
0	22 11 53.335	120° 564	0	23 42 47.550	108° 099
1	22 13 53.899	120° 207	1	23 44 35.649	107° 949
2	22 15 54.106	119° 853	2	23 46 23.598	107° 804
3	22 17 53.959	119° 504	3	23 48 11.402	107° 662
4	22 19 53.463	119° 158	4	23 49 59.064	107° 526
5	22 21 52.621	118° 815	5	23 51 46.590	107° 393
6	22 23 51.436	118° 477	6	23 53 33.983	107° 267
7	22 25 49.913	118° 143	7	23 55 21.250	107° 143
8	22 27 48.056	117° 812	8	23 57 08.393	107° 026
9	22 29 45.868	117° 485	9	23 58 55.419	106° 912
10	22 31 43.353	117° 162	10	00 00 42.331	106° 803
11	22 33 40.515	116° 844	11	00 02 29.134	106° 699
12	22 35 37.359	116° 528	12	00 04 15.833	106° 599
13	22 37 33.887	116° 219	13	00 06 02.432	106° 505
14	22 39 30.106	115° 911	14	00 07 48.937	106° 413
15	22 41 26.017	115° 610	15	00 09 35.350	106° 328
16	22 43 21.627	115° 311	16	00 11 21.678	106° 247
17	22 45 16.938	115° 017	17	00 13 07.925	106° 170
18	22 47 11.955	114° 728	18	00 14 54.095	106° 098
19	22 49 06.683	114° 442	19	00 16 40.193	106° 031
20	22 51 01.125	114° 161	20	00 18 26.224	105° 968
21	22 52 55.286	113° 885	21	00 20 12.192	105° 909
22	22 54 49.171	113° 612	22	00 21 58.101	105° 856
23	22 56 42.783	113° 343	23	00 23 43.957	105° 807
July 25			July 27		
0	22 58 36.126	113° 080	0	00 25 29.764	105° 762
1	23 00 29.206	112° 821	1	00 27 15.526	105° 723
2	23 02 22.027	112° 566	2	00 29 01.249	105° 687
3	23 04 14.593	112° 315	3	00 30 46.936	105° 656
4	23 06 06.908	112° 070	4	00 32 32.592	105° 631
5	23 07 58.978	111° 827	5	00 34 18.223	105° 608
6	23 09 50.805	111° 591	6	00 36 03.831	105° 592
7	23 11 42.396	111° 358	7	00 37 49.423	105° 579
8	23 13 33.754	111° 130	8	00 39 35.002	105° 571
9	23 15 24.884	110° 906	9	00 41 20.573	105° 568
10	23 17 15.790	110° 687	10	00 43 06.141	105° 569
11	23 19 06.477	110° 473	11	00 44 51.710	105° 575
12	23 20 56.950	110° 263	12	00 46 37.285	105° 585
13	23 22 47.213	110° 057	13	00 48 22.870	105° 600
14	23 24 37.270	109° 857	14	00 50 08.470	105° 619
15	23 26 27.127	109° 660	15	00 51 54.089	105° 643
16	23 28 16.787	109° 468	16	00 53 39.732	105° 672
17	23 30 06.255	109° 281	17	00 55 25.404	105° 704
18	23 31 55.536	109° 099	18	00 57 11.108	105° 742
19	23 33 44.635	108° 920	19	00 58 56.850	105° 784
20	23 35 33.555	108° 748	20	00 00 42.634	105° 831
21	23 37 22.303	108° 578	21	00 02 28.465	105° 881
22	23 39 10.881	108° 414	22	00 04 14.346	105° 937
23	23 40 59.295	108° 255	23	00 06 00.283	105° 997
24	23 42 47.550	108° 000	24	00 07 46.280	105° 997

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
July 28							July 30						
^h	^h	^m	^s		[°]	[']	^h	^h	^m	^s		[°]	[']
0	1 07	46	280	^s	+	5 51 23.03	0	2 35	10	665	^s	+	16 04 18.55
1	1 09	32	341	106.061		6 04 57.89	1	2 37	04	914	114.249		16 15 56.75
2	1 11	18	471	106.130		6 18 31.31	2	2 38	59	434	114.520		16 27 31.40
3	1 13	04	674	106.203		6 32 03.25	3	2 40	54	228	114.794		16 39 02.42
4	1 14	50	956	106.282		6 45 33.66	4	2 42	49	300	115.072		16 50 29.77
5	1 16	37	319	106.363		6 59 02.52	5	2 44	44	654	115.354		17 01 53.40
6	1 18	23	770	106.451		7 12 29.77	6	2 46	40	293	115.639		17 13 13.26
7	1 20	10	312	106.542		7 25 55.39	7	2 48	36	220	115.927		17 24 29.28
8	1 21	56	949	106.637		7 39 19.33	8	2 50	32	439	116.219		17 35 41.41
9	1 23	43	686	106.737		7 52 41.54	9	2 52	28	953	116.514		17 46 49.61
10	1 25	30	528	106.842		8 06 02.00	10	2 54	25	767	116.814		17 57 53.81
11	1 27	17	479	106.951		8 19 20.66	11	2 56	22	883	117.116		18 08 53.96
12	1 29	04	543	107.064		8 32 37.48	12	2 58	20	304	117.421		18 19 50.01
13	1 30	51	726	107.183		8 45 52.41	13	3 00	18	034	117.730		18 30 41.89
14	1 32	39	030	107.304		8 59 05.42	14	3 02	16	076	118.042		18 41 29.55
15	1 34	26	460	107.430		9 12 16.48	15	3 04	14	433	118.357		18 52 12.93
16	1 36	14	022	107.562		9 25 25.52	16	3 06	13	108	118.675		19 02 51.97
17	1 38	01	719	107.697		9 38 32.52	17	3 08	12	104	118.996		19 13 26.62
18	1 39	49	556	107.837		9 51 37.44	18	3 10	11	425	119.321		19 23 56.82
19	1 41	37	536	107.980		10 04 40.23	19	3 12	11	073	119.648		19 34 22.50
20	1 43	25	665	108.129		10 17 40.84	20	3 14	11	050	119.977		19 44 43.61
21	1 45	13	947	108.282		10 30 39.25	21	3 16	11	361	120.311		19 55 00.09
22	1 47	02	385	108.438		10 43 35.40	22	3 18	12	007	120.646		20 05 11.88
23	1 48	50	985	108.600		10 56 29.25	23	3 20	12	991	120.984		20 15 18.91
			108.765			+771.51				121.325			+602.21
July 29							July 31						
0	1 50	39	750	108.936	+	11 09 20.76	0	3 22	14	316	121.668	+	20 25 21.12
1	1 52	28	686	109.109		11 22 09.89	1	3 24	15	984	122.013		20 35 18.46
2	1 54	17	795	109.288		11 34 56.59	2	3 26	17	997	122.362		20 45 10.86
3	1 56	07	083	109.470		11 47 40.82	3	3 28	20	359	122.712		20 54 58.25
4	1 57	56	553	109.657		12 00 22.54	4	3 30	23	071	122.712		21 04 40.58
5	1 59	46	210	109.848		12 13 01.70	5	3 32	26	136	123.065		21 14 17.78
6	2 01	36	058	110.043		12 25 38.26	6	3 34	29	556	123.420		21 23 49.79
7	2 03	26	101	110.243		12 38 12.17	7	3 36	33	332	123.776		21 33 16.54
8	2 05	16	344	110.446		12 50 43.39	8	3 38	37	467	124.135		21 42 37.96
9	2 07	06	790	110.654		13 03 11.87	9	3 40	41	963	124.496		21 51 54.00
10	2 08	57	444	110.866		13 15 37.56	10	3 42	46	821	124.858		22 01 04.58
11	2 10	48	310	111.081		13 28 00.43	11	3 44	52	043	125.222		22 10 09.65
12	2 12	39	391	111.302		13 40 20.42	12	3 46	57	631	125.588		22 19 09.13
13	2 14	30	693	111.525		13 52 37.48	13	3 49	03	586	125.955		22 28 02.96
14	2 16	22	218	111.753		14 04 51.58	14	3 51	09	910	126.324		22 36 51.07
15	2 18	13	971	111.986		14 17 02.66	15	3 53	16	604	126.694		22 45 33.40
16	2 20	05	957	112.221		14 29 10.67	16	3 55	23	669	127.065		22 54 09.87
17	2 21	58	178	112.462		14 41 15.57	17	3 57	31	107	127.438		23 02 40.42
18	2 23	50	640	112.705		14 53 17.31	18	3 59	38	918	127.811		23 11 04.98
19	2 25	43	345	112.953		15 05 15.83	19	4 01	47	103	128.185		23 19 23.48
20	2 27	36	298	113.205		15 17 11.10	20	4 03	55	663	128.560		23 27 35.86
21	2 29	29	503	113.460		15 29 03.05	21	4 06	04	598	128.935		23 35 42.04
22	2 31	22	963	113.719		15 40 51.65	22	4 08	13	910	129.312		23 43 41.96
23	2 33	16	682	113.983		15 52 36.83	23	4 10	23	599	129.689		23 51 35.55
24	2 35	10	665		+	16 04 18.55	24	4 12	33	665	130.066	+	23 59 22.73

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
August 1			August 3		
h	h m s	° ' "	h	h m s	° ' "
0	4 12 33.665 ^s	+23 59 22.73 ["]	0	6 03 33.302 ^s	+27 45 09.29 ["]
1	4 14 44.108 ^s	24 07 03.44 ["]	1	6 05 59.420 ^s	27 46 20.19 ["]
2	4 16 54.928 ^s	24 14 37.61 ["]	2	6 08 25.756 ^s	27 47 21.53 ["]
3	4 19 06.126 ^s	24 22 05.17 ["]	3	6 10 52.304 ^s	27 48 13.27 ["]
4	4 21 17.701 ^s	24 29 26.04 ["]	4	6 13 19.056 ^s	27 48 55.36 ["]
5	4 23 29.653 ^s	24 36 40.17 ["]	5	6 15 46.006 ^s	27 49 27.77 ["]
6	4 25 41.981 ^s	24 43 47.47 ["]	6	6 18 13.148 ^s	27 49 50.45 ["]
7	4 27 54.685 ^s	24 50 47.88 ["]	7	6 20 40.473 ^s	27 50 03.37 ["]
8	4 30 07.764 ^s	24 57 41.33 ["]	8	6 23 07.976 ^s	27 50 06.48 ["]
9	4 32 21.218 ^s	25 04 27.74 ["]	9	6 25 35.648 ^s	27 49 59.77 ["]
10	4 34 35.045 ^s	25 11 07.05 ["]	10	6 28 03.483 ^s	27 49 43.18 ["]
11	4 36 49.245 ^s	25 17 39.19 ["]	11	6 30 31.474 ^s	27 49 16.70 ["]
12	4 39 03.815 ^s	25 24 04.08 ["]	12	6 32 59.613 ^s	27 48 40.28 ["]
13	4 41 18.756 ^s	25 30 21.66 ["]	13	6 35 27.892 ^s	27 47 53.91 ["]
14	4 43 34.065 ^s	25 36 31.86 ["]	14	6 37 56.304 ^s	27 46 57.56 ["]
15	4 45 49.740 ^s	25 42 34.60 ["]	15	6 40 24.843 ^s	27 45 51.19 ["]
16	4 48 05.781 ^s	25 48 29.82 ["]	16	6 42 53.499 ^s	27 44 34.79 ["]
17	4 50 22.184 ^s	25 54 17.45 ["]	17	6 45 22.266 ^s	27 43 08.33 ["]
18	4 52 38.948 ^s	25 59 57.42 ["]	18	6 47 51.136 ^s	27 41 31.80 ["]
19	4 54 56.071 ^s	26 05 29.66 ["]	19	6 50 20.100 ^s	27 39 45.17 ["]
20	4 57 13.550 ^s	26 10 54.10 ["]	20	6 52 49.153 ^s	27 37 48.44 ["]
21	4 59 31.382 ^s	26 16 10.67 ["]	21	6 55 18.285 ^s	27 35 41.57 ["]
22	5 01 49.566 ^s	26 21 19.31 ["]	22	6 57 47.489 ^s	27 33 24.57 ["]
23	5 04 08.098 ^s	+26 26 19.95 ["]	23	7 00 16.757 ^s	+27 30 57.42 ["]
	138.877	+292.57		149.325	-157.32
August 2			August 4		
0	5 06 26.975 ^s	+26 31 12.52 ["]	0	7 02 46.082 ^s	+27 28 20.10 ["]
1	5 08 46.194 ^s	26 35 56.95 ["]	1	7 05 15.456 ^s	27 25 32.62 ["]
2	5 11 05.752 ^s	26 40 33.18 ["]	2	7 07 44.870 ^s	27 22 34.96 ["]
3	5 13 25.645 ^s	26 45 01.14 ["]	3	7 10 14.318 ^s	27 19 27.12 ["]
4	5 15 45.871 ^s	26 49 20.77 ["]	4	7 12 43.792 ^s	27 16 09.11 ["]
5	5 18 06.424 ^s	26 53 32.00 ["]	5	7 15 13.283 ^s	27 12 40.91 ["]
6	5 20 27.302 ^s	26 57 34.77 ["]	6	7 17 42.785 ^s	27 09 02.53 ["]
7	5 22 48.500 ^s	27 01 29.01 ["]	7	7 20 12.289 ^s	27 05 13.98 ["]
8	5 25 10.014 ^s	27 05 14.67 ["]	8	7 22 41.789 ^s	27 01 15.25 ["]
9	5 27 31.841 ^s	27 08 51.68 ["]	9	7 25 11.275 ^s	26 57 06.36 ["]
10	5 29 53.974 ^s	27 12 19.97 ["]	10	7 27 40.742 ^s	26 52 47.32 ["]
11	5 32 16.410 ^s	27 15 39.50 ["]	11	7 30 10.181 ^s	26 48 18.13 ["]
12	5 34 39.145 ^s	27 18 50.19 ["]	12	7 32 39.585 ^s	26 43 38.81 ["]
13	5 37 02.173 ^s	27 21 52.00 ["]	13	7 35 08.947 ^s	26 38 49.37 ["]
14	5 39 25.488 ^s	27 24 44.85 ["]	14	7 37 38.260 ^s	26 33 49.83 ["]
15	5 41 49.087 ^s	27 27 28.71 ["]	15	7 40 07.516 ^s	26 28 40.21 ["]
16	5 44 12.964 ^s	27 30 03.50 ["]	16	7 42 36.708 ^s	26 23 20.53 ["]
17	5 46 37.113 ^s	27 32 29.18 ["]	17	7 45 05.829 ^s	26 17 50.80 ["]
18	5 49 01.529 ^s	27 34 45.69 ["]	18	7 47 34.873 ^s	26 12 11.06 ["]
19	5 51 26.207 ^s	27 36 52.97 ["]	19	7 50 03.832 ^s	26 06 21.33 ["]
20	5 53 51.139 ^s	27 38 50.98 ["]	20	7 52 32.699 ^s	26 00 21.63 ["]
21	5 56 16.321 ^s	27 40 39.67 ["]	21	7 55 01.469 ^s	25 54 12.00 ["]
22	5 58 41.746 ^s	27 42 18.98 ["]	22	7 57 30.134 ^s	25 47 52.46 ["]
23	6 01 07.409 ^s	27 43 48.87 ["]	23	7 59 58.689 ^s	25 41 23.05 ["]
24	6 03 33.302 ^s	+27 45 09.29 ["]	24	8 02 27.126 ^s	+25 34 43.81 ["]
	145.893	+80.42		148.437	-399.24

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
August 5			August 7		
0	8 02 27.126 ^s	+25 34 43.81 ^s	0	9 57 24.373 ^s	+17 20 22.03 ^s
1	8 04 55.439 ^s	25 27 54.77 ^s	1	9 59 42.230 ^s	17 06 54.44 ^s
2	8 07 23.623 ^s	25 20 55.97 ^s	2	10 01 59.836 ^s	16 53 20.53 ^s
3	8 09 51.671 ^s	25 13 47.44 ^s	3	10 04 17.192 ^s	16 39 40.37 ^s
4	8 12 19.578 ^s	25 06 29.23 ^s	4	10 06 34.300 ^s	16 25 54.07 ^s
5	8 14 47.337 ^s	24 59 01.39 ^s	5	10 08 51.160 ^s	16 12 01.72 ^s
6	8 17 14.944 ^s	24 51 23.96 ^s	6	10 11 07.774 ^s	15 58 03.41 ^s
7	8 19 42.393 ^s	24 43 36.98 ^s	7	10 13 24.144 ^s	15 43 59.25 ^s
8	8 22 09.678 ^s	24 35 40.50 ^s	8	10 15 40.272 ^s	15 29 49.32 ^s
9	8 24 36.795 ^s	24 27 34.57 ^s	9	10 17 56.158 ^s	15 15 33.72 ^s
10	8 27 03.738 ^s	24 19 19.25 ^s	10	10 20 11.805 ^s	15 01 12.56 ^s
11	8 29 30.502 ^s	24 10 54.59 ^s	11	10 22 27.215 ^s	14 46 45.92 ^s
12	8 31 57.083 ^s	24 02 20.64 ^s	12	10 24 42.390 ^s	14 32 13.90 ^s
13	8 34 23.475 ^s	23 53 37.45 ^s	13	10 26 57.332 ^s	14 17 36.61 ^s
14	8 36 49.676 ^s	23 44 45.09 ^s	14	10 29 12.043 ^s	14 02 54.14 ^s
15	8 39 15.679 ^s	23 35 43.61 ^s	15	10 31 26.527 ^s	13 48 06.59 ^s
16	8 41 41.482 ^s	23 26 33.08 ^s	16	10 33 40.784 ^s	13 33 14.06 ^s
17	8 44 07.079 ^s	23 17 13.55 ^s	17	10 35 54.819 ^s	13 18 16.65 ^s
18	8 46 32.468 ^s	23 07 45.10 ^s	18	10 38 08.633 ^s	13 03 14.45 ^s
19	8 48 57.645 ^s	22 58 07.78 ^s	19	10 40 22.229 ^s	12 48 07.57 ^s
20	8 51 22.606 ^s	22 48 21.65 ^s	20	10 42 35.611 ^s	12 32 56.10 ^s
21	8 53 47.347 ^s	22 38 26.80 ^s	21	10 44 48.781 ^s	12 17 40.14 ^s
22	8 56 11.865 ^s	22 28 23.28 ^s	22	10 47 01.742 ^s	12 02 19.80 ^s
23	8 58 36.159 ^s	+22 18 11.17 ^s	23	10 49 14.497 ^s	+11 46 55.18 ^s
	144.064	-620.64		132.553	-928.82
August 6			August 8		
0	9 01 00.223 ^s	+22 07 50.53 ^s	0	10 51 27.050 ^s	+11 31 26.36 ^s
1	9 03 24.056 ^s	21 57 21.45 ^s	1	10 53 39.404 ^s	11 15 53.47 ^s
2	9 05 47.655 ^s	21 46 43.99 ^s	2	10 55 51.562 ^s	11 00 16.58 ^s
3	9 08 11.018 ^s	21 35 58.22 ^s	3	10 58 03.528 ^s	10 44 35.81 ^s
4	9 10 34.143 ^s	21 25 04.23 ^s	4	11 00 15.305 ^s	10 28 51.26 ^s
5	9 12 57.026 ^s	21 14 02.08 ^s	5	11 02 26.897 ^s	10 13 03.02 ^s
6	9 15 19.667 ^s	21 02 51.87 ^s	6	11 04 38.307 ^s	9 57 11.20 ^s
7	9 17 42.064 ^s	20 51 33.66 ^s	7	11 06 49.539 ^s	9 41 15.89 ^s
8	9 20 04.214 ^s	20 40 07.54 ^s	8	11 09 00.597 ^s	9 25 17.20 ^s
9	9 22 26.117 ^s	20 28 33.58 ^s	9	11 11 11.485 ^s	9 09 15.23 ^s
10	9 24 47.770 ^s	20 16 51.87 ^s	10	11 13 22.207 ^s	8 53 10.08 ^s
11	9 27 09.174 ^s	20 05 02.50 ^s	11	11 15 32.766 ^s	8 37 01.84 ^s
12	9 29 30.326 ^s	19 53 05.54 ^s	12	11 17 43.167 ^s	8 20 50.62 ^s
13	9 31 51.226 ^s	19 41 01.08 ^s	13	11 19 53.414 ^s	8 04 36.52 ^s
14	9 34 11.873 ^s	19 28 49.21 ^s	14	11 22 03.511 ^s	7 48 19.64 ^s
15	9 36 32.266 ^s	19 16 30.01 ^s	15	11 24 13.462 ^s	7 32 00.08 ^s
16	9 38 52.406 ^s	19 04 03.57 ^s	16	11 26 23.271 ^s	7 15 37.94 ^s
17	9 41 12.291 ^s	18 51 29.97 ^s	17	11 28 32.943 ^s	6 59 13.32 ^s
18	9 43 31.922 ^s	18 38 49.31 ^s	18	11 30 42.482 ^s	6 42 46.32 ^s
19	9 45 51.299 ^s	18 26 01.68 ^s	19	11 32 51.892 ^s	6 26 17.04 ^s
20	9 48 10.421 ^s	18 13 07.16 ^s	20	11 35 01.178 ^s	6 09 45.58 ^s
21	9 50 29.289 ^s	18 00 05.84 ^s	21	11 37 10.344 ^s	5 53 12.05 ^s
22	9 52 47.903 ^s	17 46 57.82 ^s	22	11 39 19.396 ^s	5 36 36.53 ^s
23	9 55 06.264 ^s	17 33 43.18 ^s	23	11 41 28.336 ^s	5 19 59.13 ^s
24	9 57 24.373 ^s	+17 20 22.03 ^s	24	11 43 37.171 ^s	+5 03 19.95 ^s
	138.109	-801.15		128.835	-999.18

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
August 9							August 11						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	11	43	37.171	128.733	+	5 03 19.95	0	13	26	11.992	129.643	-	8 18 56.28
1	11	45	45.904	128.637		4 46 39.08	1	13	28	21.635	129.783		8 35 03.52
2	11	47	54.541	128.544		4 29 56.64	2	13	30	31.418	129.927		8 51 07.74
3	11	50	03.085	128.457		4 13 12.71	3	13	32	41.345	130.074		9 07 08.84
4	11	52	11.542	128.375		3 56 27.40	4	13	34	51.419	130.228		9 23 06.73
5	11	54	19.917	128.296		3 39 40.81	5	13	37	01.647	130.384		9 39 01.32
6	11	56	28.213	128.224		3 22 53.03	6	13	39	12.031	130.547		9 54 52.50
7	11	58	36.437	128.156		3 06 04.16	7	13	41	22.578	130.712		10 10 40.20
8	12	00	44.593	128.092		2 49 14.30	8	13	43	33.290	130.883		10 26 24.32
9	12	02	52.685	128.034		2 32 23.56	9	13	45	44.173	131.058		10 42 04.76
10	12	05	00.719	127.980		2 15 32.02	10	13	47	55.231	131.237		10 57 41.43
11	12	07	08.699	127.932		1 58 39.79	11	13	50	06.468	131.419		11 13 14.25
12	12	09	16.631	127.888		1 41 46.96	12	13	52	17.887	131.608		11 28 43.11
13	12	11	24.519	127.849		1 24 53.63	13	13	54	29.495	131.798		11 44 07.93
14	12	13	32.368	127.816		1 07 59.91	14	13	56	41.293	131.994		11 59 28.62
15	12	15	40.184	127.787		0 51 05.88	15	13	58	53.287	132.193		12 14 45.08
16	12	17	47.971	127.763		0 34 11.65	16	14	01	05.480	132.396		12 29 57.23
17	12	19	55.734	127.744		0 17 17.31	17	14	03	17.876	132.603		12 45 04.97
18	12	22	03.478	127.730	+	0 00 22.96	18	14	05	30.479	132.815		13 00 08.20
19	12	24	11.208	127.722	-	0 16 31.31	19	14	07	43.294	133.028		13 15 06.85
20	12	26	18.930	127.718		0 33 25.38	20	14	09	56.322	133.247		13 30 00.82
21	12	28	26.648	127.720		0 50 19.18	21	14	12	09.569	133.468		13 44 50.01
22	12	30	34.368	127.726		1 07 12.61	22	14	14	23.037	133.694		13 59 34.34
23	12	32	42.094	127.737	-	1 24 05.56	23	14	16	36.731	133.922	-	14 14 13.71
August 10							August 12						
0	12	34	49.831	127.754	-	1 40 57.94	0	14	18	50.653	134.154	-	14 28 48.05
1	12	36	57.585	127.775		1 57 49.65	1	14	21	04.807	134.389		14 43 17.24
2	12	39	05.360	127.802		2 14 40.60	2	14	23	19.196	134.627		14 57 41.22
3	12	41	13.162	127.833		2 31 30.70	3	14	25	33.823	134.868		15 11 59.88
4	12	43	20.995	127.870		2 48 19.84	4	14	27	48.691	135.113		15 26 13.13
5	12	45	28.865	127.912		3 05 07.93	5	14	30	03.804	135.359		15 40 20.89
6	12	47	36.777	127.959		3 21 54.88	6	14	32	19.163	135.610		15 54 23.07
7	12	49	44.736	128.010		3 38 40.59	7	14	34	34.773	135.862		16 08 19.57
8	12	51	52.746	128.067		3 55 24.96	8	14	36	50.635	136.117		16 22 10.32
9	12	54	00.813	128.129		4 12 07.91	9	14	39	06.752	136.375		16 35 55.21
10	12	56	08.942	128.196		4 28 49.33	10	14	41	23.127	136.635		16 49 34.17
11	12	58	17.138	128.267		4 45 29.13	11	14	43	39.762	136.898		17 03 07.09
12	13	00	25.405	128.344		5 02 07.21	12	14	45	56.660	137.161		17 16 33.91
13	13	02	33.749	128.425		5 18 43.49	13	14	48	13.821	137.428		17 29 54.52
14	13	04	42.174	128.512		5 35 17.87	14	14	50	31.249	137.697		17 43 08.84
15	13	06	50.686	128.604		5 51 50.25	15	14	52	48.946	137.967		17 56 16.78
16	13	08	59.290	128.700		6 08 20.53	16	14	55	06.913	138.239		18 09 18.25
17	13	11	07.990	128.801		6 24 48.63	17	14	57	25.152	138.513		18 22 13.18
18	13	13	16.791	128.907		6 41 14.45	18	14	59	43.665	138.787		18 35 01.47
19	13	15	25.698	129.018		6 57 37.90	19	15	02	02.452	139.065		18 47 43.03
20	13	17	34.716	129.134		7 13 58.88	20	15	04	21.517	139.341		19 00 17.78
21	13	19	43.850	129.254		7 30 17.31	21	15	06	40.858	139.621		19 12 45.64
22	13	21	53.104	129.379		7 46 33.07	22	15	09	00.479	139.900		19 25 06.52
23	13	24	02.483	129.509		8 02 46.09	23	15	11	20.379	140.180		19 37 20.34
24	13	26	11.992		-	8 18 56.28	24	15	13	40.559		-	19 49 27.00

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
August 13			August 15		
h	h m s	° ' "	h	h m s	° ' "
0	15 13 40.559 140.462	-19 49 27.00 -719.44	0	17 10 56.962 151.701	-26 45 53.32 -288.19
1	15 16 01.021 140.743	20 01 26.44 712.12	1	17 13 28.663 151.823	26 50 41.51 277.89
2	15 18 21.764 141.025	20 13 18.56 704.72	2	17 16 00.486 151.937	26 55 19.40 267.55
3	15 20 42.789 141.308	20 25 03.28 697.24	3	17 18 32.423 152.044	26 59 46.95 257.20
4	15 23 04.097 141.590	20 36 40.52 689.68	4	17 21 04.467 152.144	27 04 04.15 246.81
5	15 25 25.687 141.872	20 48 10.20 682.04	5	17 23 36.611 152.237	27 08 10.96 236.40
6	15 27 47.559 142.155	20 59 32.24 674.31	6	17 26 08.848 152.322	27 12 07.36 225.96
7	15 30 09.714 142.437	21 10 46.55 666.51	7	17 28 41.170 152.399	27 15 53.32 215.51
8	15 32 32.151 142.718	21 21 53.06 658.62	8	17 31 13.569 152.470	27 19 28.83 205.03
9	15 34 54.869 142.998	21 32 51.68 650.67	9	17 33 46.039 152.531	27 22 53.86 194.54
10	15 37 17.867 143.279	21 43 42.35 642.62	10	17 36 18.570 152.586	27 26 08.40 184.04
11	15 39 41.146 143.558	21 54 24.97 634.50	11	17 38 51.156 152.632	27 29 12.44 173.50
12	15 42 04.704 143.836	22 04 59.47 626.31	12	17 41 23.788 152.670	27 32 05.94 162.98
13	15 44 28.540 144.112	22 15 25.78 618.04	13	17 43 56.458 152.701	27 34 48.92 152.43
14	15 46 52.652 144.387	22 25 43.82 609.69	14	17 46 29.159 152.723	27 37 21.35 141.88
15	15 49 17.039 144.661	22 35 53.51 601.27	15	17 49 01.882 152.737	27 39 43.23 131.31
16	15 51 41.700 144.933	22 45 54.78 592.78	16	17 51 34.619 152.743	27 41 54.54 120.75
17	15 54 06.633 145.203	22 55 47.56 584.21	17	17 54 07.362 152.741	27 43 55.29 110.19
18	15 56 31.836 145.470	23 05 31.77 575.57	18	17 56 40.103 152.730	27 45 45.48 99.62
19	15 58 57.306 145.736	23 15 07.34 566.85	19	17 59 12.833 152.711	27 47 25.10 89.05
20	16 01 23.042 145.999	23 25 43.19 558.08	20	18 01 45.544 152.684	27 48 54.15 78.49
21	16 03 49.041 146.260	23 33 52.27 549.22	21	18 04 18.228 152.648	27 50 12.64 67.93
22	16 06 15.301 146.517	23 43 01.49 540.31	22	18 06 50.876 152.604	27 51 20.57 57.38
23	16 08 41.818 146.772	-23 52 01.80 -531.31	23	18 09 23.480 152.552	-27 52 17.95 -46.84
August 14			August 16		
0	16 11 08.590 147.023	-24 00 53.11 -522.27	0	18 11 56.032 152.490	-27 53 04.79 -36.31
1	16 13 35.613 147.272	24 09 35.38 513.14	1	18 14 28.522 152.422	27 53 41.10 25.79
2	16 16 02.885 147.517	24 18 08.52 503.96	2	18 17 00.944 152.344	27 54 06.89 15.28
3	16 18 30.402 147.758	24 26 32.48 494.72	3	18 19 33.288 152.258	27 54 22.17 4.79
4	16 20 58.160 147.996	24 34 47.20 485.40	4	18 22 05.546 152.165	27 54 26.96 + 5.67
5	16 23 26.156 148.229	24 42 52.60 476.04	5	18 24 37.711 152.061	27 54 21.29 16.13
6	16 25 54.385 148.458	24 50 48.64 466.61	6	18 27 09.772 151.951	27 54 05.16 26.55
7	16 28 22.843 148.684	24 58 35.25 457.11	7	18 29 41.723 151.832	27 53 38.61 36.95
8	16 30 51.527 148.904	25 06 12.36 447.58	8	18 32 13.555 151.706	27 53 01.66 47.33
9	16 33 20.431 149.121	25 13 39.94 437.97	9	18 34 45.261 151.569	27 52 14.33 57.68
10	16 35 49.552 149.331	25 20 57.91 428.32	10	18 37 16.830 151.427	27 51 16.65 68.01
11	16 38 18.883 149.538	25 28 06.23 418.60	11	18 39 48.257 151.275	27 50 08.64 78.29
12	16 40 48.421 149.740	25 35 04.83 408.85	12	18 42 19.532 151.116	27 48 50.35 88.55
13	16 43 18.161 149.935	25 41 53.68 399.04	13	18 44 50.648 150.950	27 47 21.80 98.77
14	16 45 48.096 150.126	25 48 32.72 389.17	14	18 47 21.598 150.774	27 45 43.03 108.96
15	16 48 18.222 150.311	25 55 01.89 379.26	15	18 49 52.372 150.592	27 43 54.07 119.11
16	16 50 48.533 150.490	26 01 21.15 369.31	16	18 52 22.964 150.401	27 41 54.96 129.21
17	16 53 19.023 150.663	26 07 30.46 359.31	17	18 54 53.365 150.205	27 39 45.75 139.28
18	16 55 49.686 150.831	26 13 29.77 349.27	18	18 57 23.570 149.999	27 37 26.47 149.31
19	16 58 20.517 150.992	26 19 19.04 339.18	19	18 59 53.569 149.786	27 34 57.16 159.28
20	17 00 51.509 151.147	26 24 58.22 329.06	20	19 02 23.355 149.568	27 32 17.88 169.22
21	17 03 22.656 151.296	26 30 27.28 318.89	21	19 04 52.923 149.340	27 29 28.66 179.10
22	17 05 53.952 151.437	26 35 46.17 308.70	22	19 07 22.263 149.107	27 26 29.56 188.94
23	17 08 25.389 151.573	26 40 54.87 -298.45	23	19 09 51.370 148.866	27 23 20.62 +198.73
24	17 10 56.962	-26 45 53.32	24	19 12 20.236	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
August 17			August 19		
^h 0	^h 19 12 20.236 ^m 148.619 ^s	[°] -27 20 01.89 ['] +208.46 ["]	^h 0	^h 21 05 04.003 ^m 131.694 ^s	[°] -21 50 37.46 ['] +593.91 ["]
1	19 14 48.855 148.365	27 16 33.43 218.14	1	21 07 15.697 131.297	21 40 43.55 599.99
2	19 17 17.220 148.105	27 12 55.29 227.76	2	21 09 26.994 130.902	21 30 43.56 605.98
3	19 19 45.325 147.838	27 09 07.53 237.33	3	21 11 37.896 130.508	21 20 37.58 611.88
4	19 22 13.163 147.565	27 05 10.20 246.84	4	21 13 48.404 130.114	21 10 25.70 617.72
5	19 24 40.728 147.286	27 01 03.36 256.29	5	21 15 58.518 129.721	21 00 07.98 623.46
6	19 27 08.014 147.001	26 56 47.07 265.69	6	21 18 08.239 129.329	20 49 44.52 629.11
7	19 29 35.015 146.710	26 52 21.38 275.01	7	21 20 17.568 128.939	20 39 15.41 634.70
8	19 32 01.725 146.413	26 47 46.37 284.29	8	21 22 26.507 128.550	20 28 40.71 640.19
9	19 34 28.138 146.112	26 43 02.08 293.48	9	21 24 35.057 128.161	20 18 00.52 645.60
10	19 36 54.250 145.804	26 38 08.60 302.62	10	21 26 43.218 127.775	20 07 14.92 650.93
11	19 39 20.054 145.492	26 33 05.98 311.70	11	21 28 50.993 127.390	19 56 23.99 656.18
12	19 41 45.546 145.174	26 27 54.28 320.70	12	21 30 58.383 127.007	19 45 27.81 661.35
13	19 44 10.720 144.851	26 22 33.58 329.63	13	21 33 05.390 126.626	19 34 26.46 666.44
14	19 46 35.571 144.524	26 17 03.95 338.50	14	21 35 12.016 126.245	19 23 20.02 671.44
15	19 49 00.095 144.192	26 11 25.45 347.30	15	21 37 18.261 125.869	19 12 08.58 676.36
16	19 51 24.287 143.856	26 05 38.15 356.03	16	21 39 24.130 125.492	19 00 52.22 681.21
17	19 53 48.143 143.515	25 59 42.12 364.67	17	21 41 29.622 125.119	18 49 31.01 685.97
18	19 56 11.658 143.171	25 53 37.45 373.26	18	21 43 34.741 124.748	18 38 05.04 690.65
19	19 58 34.829 142.822	25 47 24.19 381.77	19	21 45 39.489 124.378	18 26 34.39 695.26
20	20 00 57.651 142.469	25 41 02.42 390.20	20	21 47 43.867 124.012	18 14 59.13 699.79
21	20 03 20.120 142.113	25 34 32.22 398.55	21	21 49 47.879 123.647	18 03 19.34 704.23
22	20 05 42.233 141.754	25 27 53.67 406.84	22	21 51 51.526 123.286	17 51 35.11 708.60
23	20 08 03.987 141.391	-25 21 06.83 +415.04	23	21 53 54.812 122.927	-17 39 46.51 +712.90
August 18			August 20		
0	20 10 25.378 141.024	-25 14 11.79 +423.17	0	21 55 57.739 122.570	-17 27 53.61 +717.11
1	20 12 46.402 140.656	25 07 08.62 431.22	1	21 58 00.309 122.216	17 15 56.50 721.24
2	20 15 07.058 140.283	24 59 57.40 439.19	2	22 00 02.525 121.866	17 03 55.26 725.31
3	20 17 27.341 139.909	24 52 38.21 447.08	3	22 02 04.391 121.517	16 51 49.95 729.29
4	20 19 47.250 139.532	24 45 11.13 454.90	4	22 04 05.908 121.172	16 39 40.66 733.20
5	20 22 06.782 139.153	24 37 36.23 462.62	5	22 06 07.080 120.829	16 27 27.46 737.04
6	20 24 25.935 138.771	24 29 53.61 470.28	6	22 08 07.909 120.491	16 15 10.42 740.79
7	20 26 44.706 138.387	24 22 03.33 477.85	7	22 10 08.400 120.154	16 02 49.63 744.48
8	20 29 03.093 138.001	24 14 05.48 485.34	8	22 12 08.554 119.822	15 50 25.15 748.09
9	20 31 21.094 137.614	24 06 00.14 492.74	9	22 14 08.376 119.491	15 37 57.06 751.63
10	20 33 38.708 137.225	23 57 47.40 500.07	10	22 16 07.867 119.165	15 25 25.43 755.10
11	20 35 55.933 136.835	23 49 27.33 507.32	11	22 18 07.032 118.842	15 12 50.33 758.48
12	20 38 12.768 136.443	23 41 00.01 514.48	12	22 20 05.874 118.522	15 00 11.85 761.81
13	20 40 29.211 136.050	23 32 25.53 521.55	13	22 22 04.396 118.206	14 47 30.04 765.06
14	20 42 45.261 135.656	23 23 43.98 528.55	14	22 24 02.602 117.892	14 34 44.98 768.23
15	20 45 00.917 135.261	23 14 55.43 535.46	15	22 26 00.494 117.583	14 21 56.75 771.35
16	20 47 16.178 134.866	23 05 59.97 542.29	16	22 27 58.077 117.277	14 09 05.40 774.38
17	20 49 31.044 134.470	22 56 57.68 549.04	17	22 29 55.354 116.974	13 56 11.02 777.35
18	20 51 45.514 134.074	22 47 48.64 555.69	18	22 31 52.328 116.675	13 43 13.67 780.25
19	20 53 59.588 133.677	22 38 32.95 562.28	19	22 33 49.003 116.380	13 30 13.42 783.08
20	20 56 13.265 133.280	22 29 10.67 568.77	20	22 35 45.383 116.089	13 17 10.34 785.84
21	20 58 26.545 132.883	22 19 41.90 575.18	21	22 37 41.472 115.800	13 04 04.50 788.54
22	21 00 39.428 132.486	22 10 06.72 581.51	22	22 39 37.272 115.516	12 50 55.96 791.17
23	21 02 51.914 132.089	22 00 25.21 +587.75	23	22 41 32.788 115.236	12 37 44.79 +793.73
24	21 05 04.003	-21 50 37.46	24	22 43 28.024	-12 24 31.06

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
August 21			August 23		
h	h m s	° ' "	h	h m s	° ' "
0	22 43 28.024 ^s	-12 24 31.06 ["]	0	0 11 28.243 ^s	-1 19 04.49 ["]
1	22 45 22.983 ^s	114.959 ["]	1	0 13 14.716 ^s	1 04 57.06 ["]
2	22 47 17.670 ^s	114.687 ["]	2	0 15 01.117 ^s	0 50 49.83 ["]
3	22 49 12.087 ^s	114.417 ["]	3	0 16 47.447 ^s	0 36 42.84 ["]
4	22 51 06.239 ^s	114.152 ["]	4	0 18 33.713 ^s	0 22 36.14 ["]
5	22 53 00.130 ^s	113.891 ["]	5	0 20 19.919 ^s	0 08 29.78 ["]
6	22 54 53.764 ^s	113.634 ["]	6	0 22 06.067 ^s	+ 0 05 36.21 ["]
7	22 56 47.144 ^s	113.380 ["]	7	0 23 52.164 ^s	0 19 41.76 ["]
8	22 58 40.275 ^s	113.131 ["]	8	0 25 38.213 ^s	0 33 46.85 ["]
9	23 00 33.161 ^s	112.886 ["]	9	0 27 24.217 ^s	0 47 51.42 ["]
10	23 02 25.805 ^s	112.644 ["]	10	0 29 10.183 ^s	1 01 55.43 ["]
11	23 04 18.212 ^s	112.407 ["]	11	0 30 56.113 ^s	1 15 58.83 ["]
12	23 06 10.385 ^s	112.173 ["]	12	0 32 42.012 ^s	1 30 01.59 ["]
13	23 08 02.329 ^s	111.944 ["]	13	0 34 27.885 ^s	1 44 03.66 ["]
14	23 09 54.048 ^s	111.719 ["]	14	0 36 13.735 ^s	1 58 04.99 ["]
15	23 11 45.546 ^s	111.498 ["]	15	0 37 59.566 ^s	2 12 05.54 ["]
16	23 13 36.827 ^s	111.281 ["]	16	0 39 45.384 ^s	2 26 05.26 ["]
17	23 15 27.895 ^s	111.068 ["]	17	0 41 31.191 ^s	2 40 04.12 ["]
18	23 17 18.754 ^s	110.859 ["]	18	0 43 16.994 ^s	2 54 02.08 ["]
19	23 19 09.409 ^s	110.655 ["]	19	0 45 02.794 ^s	3 07 59.07 ["]
20	23 20 59.863 ^s	110.454 ["]	20	0 46 48.598 ^s	3 21 55.08 ["]
21	23 22 50.120 ^s	110.257 ["]	21	0 48 34.409 ^s	3 35 50.04 ["]
22	23 24 40.186 ^s	110.066 ["]	22	0 50 20.230 ^s	3 49 43.93 ["]
23	23 26 30.063 ^s	109.877 ["]	23	0 52 06.068 ^s	+ 4 03 36.69 ["]
	109.694 ["]	-7 10 53.80 ["]		105.857 ["]	+ 831.59 ["]
August 22			August 24		
0	23 28 19.757 ^s	-6 56 57.27 ["]	0	0 53 51.925 ^s	+ 4 17 28.28 ["]
1	23 30 09.271 ^s	109.514 ["]	1	0 55 37.806 ^s	4 31 18.67 ["]
2	23 31 58.609 ^s	109.338 ["]	2	0 57 23.715 ^s	4 45 07.80 ["]
3	23 33 47.777 ^s	109.168 ["]	3	0 59 09.656 ^s	4 58 55.65 ["]
4	23 35 36.777 ^s	108.999 ["]	4	1 00 55.634 ^s	5 12 42.16 ["]
5	23 37 25.615 ^s	108.838 ["]	5	1 02 41.652 ^s	5 26 27.29 ["]
6	23 39 14.294 ^s	108.679 ["]	6	1 04 27.715 ^s	5 40 11.00 ["]
7	23 41 02.818 ^s	108.524 ["]	7	1 06 13.827 ^s	5 53 53.25 ["]
8	23 42 51.193 ^s	108.375 ["]	8	1 07 59.992 ^s	6 07 34.00 ["]
9	23 44 39.422 ^s	108.229 ["]	9	1 09 46.215 ^s	6 21 13.21 ["]
10	23 46 27.509 ^s	108.087 ["]	10	1 11 32.499 ^s	6 34 50.82 ["]
11	23 48 15.459 ^s	107.950 ["]	11	1 13 18.849 ^s	6 48 26.81 ["]
12	23 50 03.276 ^s	107.817 ["]	12	1 15 05.268 ^s	7 02 01.13 ["]
13	23 51 50.963 ^s	107.687 ["]	13	1 16 51.761 ^s	7 15 33.74 ["]
14	23 53 38.527 ^s	107.564 ["]	14	1 18 38.333 ^s	7 29 04.59 ["]
15	23 55 25.970 ^s	107.443 ["]	15	1 20 24.986 ^s	7 42 33.65 ["]
16	23 57 13.296 ^s	107.326 ["]	16	1 22 11.726 ^s	7 56 00.87 ["]
17	23 59 00.511 ^s	107.215 ["]	17	1 23 58.556 ^s	8 09 26.21 ["]
18	0 00 47.619 ^s	107.108 ["]	18	1 25 45.481 ^s	8 22 49.62 ["]
19	0 02 34.623 ^s	107.004 ["]	19	1 27 32.504 ^s	8 36 11.08 ["]
20	0 04 21.528 ^s	106.905 ["]	20	1 29 19.630 ^s	8 49 30.52 ["]
21	0 06 08.338 ^s	106.810 ["]	21	1 31 06.863 ^s	9 02 47.92 ["]
22	0 07 55.058 ^s	106.720 ["]	22	1 32 54.207 ^s	9 16 03.23 ["]
23	0 09 41.691 ^s	106.633 ["]	23	1 34 41.666 ^s	9 29 16.41 ["]
24	0 11 28.243 ^s	106.552 ["]	24	1 36 29.243 ^s	+ 9 42 27.41 ["]
		-1 19 04.49 ["]			+ 791.00 ["]

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
August 25			August 27		
h	h m s	° ' " s	h	h m s	° ' " s
0	1 36 29.243	107.701	0	3 06 09.048	118.062
1	1 38 16.944	107.827	1	3 08 07.110	118.361
2	1 40 04.771	107.959	2	3 10 05.471	118.661
3	1 41 52.730	108.094	3	3 12 04.132	118.966
4	1 43 40.824	108.233	4	3 14 03.098	119.272
5	1 45 29.057	108.376	5	3 16 02.370	119.582
6	1 47 17.433	108.524	6	3 18 01.952	119.893
7	1 49 05.957	108.674	7	3 20 01.845	120.207
8	1 50 54.631	108.830	8	3 22 02.052	120.524
9	1 52 43.461	108.988	9	3 24 02.576	120.842
10	1 54 32.449	109.152	10	3 26 03.418	121.164
11	1 56 21.601	109.318	11	3 28 04.582	121.487
12	1 58 10.919	109.489	12	3 30 06.069	121.813
13	2 00 00.408	109.664	13	3 32 07.882	122.140
14	2 01 50.072	109.842	14	3 34 10.022	122.470
15	2 03 39.914	110.025	15	3 36 12.492	122.802
16	2 05 29.939	110.211	16	3 38 15.294	123.134
17	2 07 20.150	110.401	17	3 40 18.428	123.470
18	2 09 10.551	110.595	18	3 42 21.898	123.807
19	2 11 01.146	110.792	19	3 44 25.705	124.145
20	2 12 51.938	110.994	20	3 46 29.850	124.486
21	2 14 42.932	111.200	21	3 48 34.336	124.827
22	2 16 34.132	111.408	22	3 50 39.163	125.169
23	2 18 25.540	111.621	23	3 52 44.332	125.514
August 26			August 28		
0	2 20 17.161	111.838	0	3 54 49.846	125.859
1	2 22 08.999	112.057	1	3 56 55.705	126.206
2	2 24 01.056	112.281	2	3 59 01.911	126.553
3	2 25 53.337	112.508	3	4 01 08.464	126.902
4	2 27 45.845	112.739	4	4 03 15.366	127.250
5	2 29 38.584	112.974	5	4 05 22.616	127.601
6	2 31 31.558	113.212	6	4 07 30.217	127.951
7	2 33 24.770	113.453	7	4 09 38.168	128.303
8	2 35 18.223	113.698	8	4 11 46.471	128.654
9	2 37 11.921	113.946	9	4 13 55.125	129.005
10	2 39 05.867	114.198	10	4 16 04.130	129.358
11	2 41 00.065	114.454	11	4 18 13.488	129.710
12	2 42 54.519	114.712	12	4 20 23.198	130.062
13	2 44 49.231	114.974	13	4 22 33.260	130.415
14	2 46 44.205	115.239	14	4 24 43.675	130.766
15	2 48 39.444	115.507	15	4 26 54.441	131.118
16	2 50 34.951	115.779	16	4 29 05.559	131.468
17	2 52 30.730	116.054	17	4 31 17.027	131.820
18	2 54 26.784	116.331	18	4 33 28.847	132.169
19	2 56 23.115	116.613	19	4 35 41.016	132.518
20	2 58 19.728	116.897	20	4 37 53.534	132.866
21	3 00 16.625	117.183	21	4 40 06.400	133.213
22	3 02 13.808	117.474	22	4 42 19.613	133.560
23	3 04 11.282	117.766	23	4 44 33.173	133.904
24	3 06 09.048		24	4 46 47.077	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
August 29							August 31						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	4 46	47.077	134.247	+25 58	50.75	+343.61	0	6 39	43.252	146.641	+27 56	28.77	-77.76
1	4 49	01.324	134.589	26 04	34.36	336.15	1	6 42	09.893	146.770	27 55	11.01	87.60
2	4 51	15.913	134.929	26 10	10.51	328.61	2	6 44	36.663	146.892	27 53	43.41	97.45
3	4 53	30.842	135.267	26 15	39.12	321.02	3	6 47	03.555	147.007	27 52	05.96	107.33
4	4 55	46.109	135.603	26 21	00.14	313.36	4	6 49	30.562	147.116	27 50	18.63	117.23
5	4 58	01.712	135.938	26 26	13.50	305.64	5	6 51	57.678	147.217	27 48	21.40	127.16
6	5 00	17.650	136.270	26 31	19.14	297.85	6	6 54	24.895	147.312	27 46	14.24	137.09
7	5 02	33.920	136.600	26 36	16.99	290.02	7	6 56	52.207	147.401	27 43	57.15	147.05
8	5 04	50.520	136.928	26 41	07.01	282.11	8	6 59	19.608	147.482	27 41	30.10	157.03
9	5 07	07.448	137.252	26 45	49.12	274.14	9	7 01	47.090	147.557	27 38	53.07	167.01
10	5 09	24.700	137.574	26 50	23.26	266.11	10	7 04	14.647	147.626	27 36	06.06	177.00
11	5 11	42.274	137.894	26 54	49.37	258.02	11	7 06	42.273	147.686	27 33	09.06	187.02
12	5 14	00.168	138.211	26 59	07.39	249.88	12	7 09	09.959	147.740	27 30	02.04	197.04
13	5 16	18.379	138.523	27 03	17.27	241.67	13	7 11	37.699	147.789	27 26	45.00	207.06
14	5 18	36.902	138.834	27 07	18.94	233.40	14	7 14	05.488	147.829	27 23	17.94	217.10
15	5 20	55.736	139.141	27 11	12.34	225.08	15	7 16	33.317	147.863	27 19	40.84	227.13
16	5 23	14.877	139.445	27 14	57.42	216.69	16	7 19	01.180	147.891	27 15	53.71	237.17
17	5 25	34.322	139.744	27 18	34.11	208.25	17	7 21	29.071	147.911	27 11	56.54	247.22
18	5 27	54.066	140.040	27 22	02.36	199.75	18	7 23	56.982	147.926	27 07	49.32	257.25
19	5 30	14.106	140.332	27 25	22.11	191.20	19	7 26	24.908	147.933	27 03	32.07	267.30
20	5 32	34.438	140.621	27 28	33.31	182.59	20	7 28	52.841	147.933	26 59	04.77	277.32
21	5 34	55.059	140.906	27 31	35.90	173.92	21	7 31	20.774	147.928	26 54	27.45	287.36
22	5 37	15.965	141.185	27 34	29.82	165.20	22	7 33	48.702	147.916	26 49	40.09	297.38
23	5 39	37.150	141.461	+27 37	15.02	+156.43	23	7 36	16.618	147.898	+26 44	42.71	-307.40
August 30							September 1						
0	5 41	58.611	141.732	+27 39	51.45	+147.60	0	7 38	44.516	147.872	+26 39	35.31	-317.40
1	5 44	20.343	141.999	27 42	19.05	138.72	1	7 41	12.388	147.841	26 34	17.91	327.39
2	5 46	42.342	142.262	27 44	37.77	129.78	2	7 43	40.229	147.804	26 28	50.52	337.37
3	5 49	04.604	142.518	27 46	47.55	120.81	3	7 46	08.033	147.759	26 23	13.15	347.33
4	5 51	27.122	142.771	27 48	48.36	111.78	4	7 48	35.792	147.710	26 17	25.82	357.27
5	5 53	49.893	143.018	27 50	40.14	102.69	5	7 51	03.502	147.654	26 11	28.55	367.21
6	5 56	12.911	143.261	27 52	22.83	93.57	6	7 53	31.156	147.592	26 05	21.34	377.11
7	5 58	36.172	143.498	27 53	56.40	84.39	7	7 55	58.748	147.525	25 59	04.23	387.00
8	6 00	59.670	143.729	27 55	20.79	75.17	8	7 58	26.273	147.451	25 52	37.23	396.85
9	6 03	23.399	143.956	27 56	35.96	65.90	9	8 00	53.724	147.372	25 46	00.38	406.69
10	6 05	47.355	144.176	27 57	41.86	56.59	10	8 03	21.096	147.287	25 39	13.69	416.51
11	6 08	11.531	144.392	27 58	38.45	47.24	11	8 05	48.383	147.197	25 32	17.18	426.28
12	6 10	35.923	144.602	27 59	25.69	37.84	12	8 08	15.580	147.101	25 25	10.90	436.03
13	6 13	00.525	144.805	28 00	03.53	28.40	13	8 10	42.681	147.000	25 17	54.87	445.75
14	6 15	25.330	145.003	28 00	31.93	18.93	14	8 13	09.681	146.894	25 10	29.12	455.44
15	6 17	50.333	145.194	28 00	50.86	9.41	15	8 15	36.575	146.783	25 02	53.68	465.09
16	6 20	15.527	145.381	28 01	00.27	0.14	16	8 18	03.358	146.667	24 55	08.59	474.70
17	6 22	40.908	145.560	28 01	00.13	9.73	17	8 20	30.025	146.546	24 47	13.89	484.27
18	6 25	06.468	145.734	28 00	50.40	19.36	18	8 22	56.571	146.420	24 39	09.62	493.81
19	6 27	32.202	145.901	28 00	31.04	29.01	19	8 25	22.991	146.290	24 30	55.81	503.31
20	6 29	58.103	146.062	28 00	02.03	38.70	20	8 27	49.281	146.155	24 22	32.50	512.75
21	6 32	24.165	146.216	27 59	23.33	48.43	21	8 30	15.436	146.016	24 13	59.75	522.17
22	6 34	50.381	146.365	27 58	34.90	58.17	22	8 32	41.452	145.873	24 05	17.58	531.52
23	6 37	16.746	146.506	27 57	36.73	67.96	23	8 35	07.325	145.724	23 56	26.06	540.84
24	6 39	43.252		+27 56	28.77		24	8 37	33.049		+23 47	25.22	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
September 2			September 4		
0	8 37 33.049 145.574	+23 47 25.22 -550.10	0	10 30 27.724 136.278	+13 53 17.48 -912.15
1	8 39 58.623 145.418	23 38 15.12 559.31	1	10 32 44.002 136.095	13 38 05.33 917.55
2	8 42 24.041 145.259	23 28 55.81 568.48	2	10 35 00.097 135.914	13 22 47.78 922.84
3	8 44 49.300 145.097	23 19 27.33 577.59	3	10 37 16.011 135.735	13 07 24.94 928.03
4	8 47 14.397 144.930	23 09 49.74 586.64	4	10 39 31.746 135.560	12 51 56.91 933.13
5	8 49 39.327 144.761	23 00 03.10 595.64	5	10 41 47.306 135.387	12 36 23.78 938.11
6	8 52 04.088 144.589	22 50 07.46 604.58	6	10 44 02.693 135.216	12 20 45.67 943.00
7	8 54 28.677 144.412	22 40 02.88 613.46	7	10 46 17.909 135.048	12 05 02.67 947.78
8	8 56 53.089 144.235	22 29 49.42 622.28	8	10 48 32.957 134.884	11 49 14.89 952.46
9	8 59 17.324 144.053	22 19 27.14 631.04	9	10 50 47.841 134.721	11 33 22.43 957.03
10	9 01 41.377 143.869	22 08 56.10 639.73	10	10 53 02.562 134.562	11 17 25.40 961.50
11	9 04 05.246 143.683	21 58 16.37 648.37	11	10 55 17.124 134.407	11 01 23.90 965.86
12	9 06 28.929 143.495	21 47 28.00 656.93	12	10 57 31.531 134.253	10 45 18.04 970.12
13	9 08 52.424 143.303	21 36 31.07 665.43	13	10 59 45.784 134.105	10 29 07.92 974.27
14	9 11 15.727 143.110	21 25 25.64 673.86	14	11 01 59.889 133.957	10 12 53.65 978.31
15	9 13 38.837 142.916	21 14 11.78 682.23	15	11 04 13.846 133.816	9 56 35.34 982.25
16	9 16 01.753 142.719	21 02 49.55 690.51	16	11 06 27.662 133.675	9 40 13.09 986.07
17	9 18 24.472 142.520	20 51 19.04 698.73	17	11 08 41.337 133.540	9 23 47.02 989.80
18	9 20 46.992 142.321	20 39 40.31 706.88	18	11 10 54.877 133.407	9 07 17.22 993.41
19	9 23 09.313 142.119	20 27 53.43 714.95	19	11 13 08.284 133.279	8 50 43.81 996.91
20	9 25 31.432 141.918	20 15 58.48 722.94	20	11 15 21.563 133.154	8 34 06.90 1000.31
21	9 27 53.350 141.713	20 03 55.54 730.86	21	11 17 34.717 133.032	8 17 26.59 1003.59
22	9 30 15.063 141.509	19 51 44.68 738.70	22	11 19 47.749 132.915	8 00 43.00 1006.77
23	9 32 36.572 141.304	+19 39 25.98 -746.47	23	11 22 00.664 132.802	+ 7 43 56.23 -1009.84
September 3			September 5		
0	9 34 57.876 141.098	+19 26 59.51 -754.15	0	11 24 13.466 132.692	+ 7 27 06.39 -1012.79
1	9 37 18.974 140.891	19 14 25.36 761.75	1	11 26 26.158 132.586	7 10 13.60 1015.64
2	9 39 39.865 140.685	19 01 43.61 769.27	2	11 28 38.744 132.484	6 53 17.96 1018.37
3	9 42 00.550 140.477	18 48 54.34 776.71	3	11 30 51.228 132.387	6 36 19.59 1021.00
4	9 44 21.027 140.270	18 35 57.63 784.06	4	11 33 03.615 132.294	6 19 18.59 1023.51
5	9 46 41.297 140.062	18 22 53.57 791.33	5	11 35 15.909 132.204	6 02 15.08 1025.92
6	9 49 01.359 139.855	18 09 42.24 798.51	6	11 37 28.113 132.119	5 45 09.16 1028.21
7	9 51 21.214 139.648	17 56 23.73 805.61	7	11 39 40.232 132.038	5 28 00.95 1030.38
8	9 53 40.862 139.442	17 42 58.12 812.62	8	11 41 52.270 131.961	5 10 50.57 1032.46
9	9 56 00.304 139.235	17 29 25.50 819.54	9	11 44 04.231 131.889	4 53 38.11 1034.41
10	9 58 19.539 139.029	17 15 45.96 826.36	10	11 46 16.120 131.821	4 36 23.70 1036.26
11	10 00 38.568 138.825	17 01 59.60 833.11	11	11 48 27.941 131.758	4 19 07.44 1037.98
12	10 02 57.393 138.620	16 48 06.49 839.75	12	11 50 39.699 131.698	4 01 49.46 1039.61
13	10 05 16.013 138.418	16 34 06.74 846.31	13	11 52 51.397 131.644	3 44 29.85 1041.12
14	10 07 34.431 138.215	16 20 00.43 852.78	14	11 55 03.041 131.593	3 27 08.73 1042.51
15	10 09 52.646 138.014	16 05 47.65 859.14	15	11 57 14.634 131.548	3 09 46.22 1043.79
16	10 12 10.660 137.815	15 51 28.51 865.43	16	11 59 26.182 131.506	2 52 22.43 1044.96
17	10 14 28.475 137.617	15 37 03.08 871.60	17	12 01 37.688 131.470	2 34 57.47 1046.02
18	10 16 46.092 137.420	15 22 31.48 877.69	18	12 03 49.158 131.438	2 17 31.45 1046.97
19	10 19 03.512 137.225	15 07 53.79 883.67	19	12 06 00.596 131.410	2 00 04.48 1047.79
20	10 21 20.737 137.032	14 53 10.12 889.57	20	12 08 12.006 131.387	1 42 36.69 1048.52
21	10 23 37.769 136.840	14 38 20.55 895.36	21	12 10 23.393 131.369	1 25 08.17 1049.12
22	10 25 54.609 136.651	14 23 25.19 901.06	22	12 12 34.762 131.356	1 07 39.05 1049.61
23	10 28 11.260 136.464	14 08 24.13 906.65	23	12 14 46.118 131.346	0 50 09.44 1050.00
24	10 30 27.724	+13 53 17.48	24	12 16 57.464	+ 0 32 39.44

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
September 6									September 8								
h	h	m	s		°	'	"		h	h	m	s		°	'	"	
0	12	16	57.464	131.343	+	0 32	39.44	1050.26	0	14	03	22.290	136.472	-12	58	15.05	-932.45
1	12	19	08.807	131.342	+	0 15	09.18	1050.42	1	14	05	38.762	136.677	13	13	47.50	927.35
2	12	21	20.149	131.348	-	0 02	21.24	1050.46	2	14	07	55.439	136.886	13	29	14.85	922.17
3	12	23	31.497	131.357	0	19	51.70	1050.39	3	14	10	12.325	137.098	13	44	37.02	916.87
4	12	25	42.854	131.373	0	37	22.09	1050.20	4	14	12	29.423	137.312	13	59	53.89	911.47
5	12	27	54.227	131.391	0	54	52.29	1049.91	5	14	14	46.735	137.530	14	15	05.36	905.97
6	12	30	05.618	131.415	1	12	22.20	1049.50	6	14	17	04.265	137.749	14	30	11.33	900.38
7	12	32	17.033	131.444	1	29	51.70	1048.98	7	14	19	22.014	137.973	14	45	11.71	894.67
8	12	34	28.477	131.477	1	47	20.68	1048.34	8	14	21	39.987	138.198	15	00	06.38	888.88
9	12	36	39.954	131.516	2	04	49.02	1047.59	9	14	23	58.185	138.426	15	14	55.26	882.98
10	12	38	51.470	131.558	2	22	16.61	1046.74	10	14	26	16.611	138.656	15	29	38.24	876.99
11	12	41	03.028	131.606	2	39	43.35	1045.76	11	14	28	35.267	138.888	15	44	15.23	870.89
12	12	43	14.634	131.658	2	57	09.11	1044.68	12	14	30	54.155	139.123	15	58	46.12	864.69
13	12	45	26.292	131.715	3	14	33.79	1043.48	13	14	33	13.278	139.360	16	13	10.81	858.41
14	12	47	38.007	131.776	3	31	57.27	1042.18	14	14	35	32.638	139.599	16	27	29.22	852.02
15	12	49	49.783	131.843	3	49	19.45	1040.75	15	14	37	52.237	139.839	16	41	41.24	845.55
16	12	52	01.626	131.914	4	06	40.20	1039.23	16	14	40	12.076	140.082	16	55	46.79	838.96
17	12	54	13.540	131.989	4	23	59.43	1037.58	17	14	42	32.158	140.326	17	09	45.75	832.29
18	12	56	25.529	132.070	4	41	17.01	1035.82	18	14	44	52.484	140.571	17	23	38.04	825.53
19	12	58	37.599	132.154	4	58	32.83	1033.96	19	14	47	13.055	140.818	17	37	23.57	818.67
20	13	00	49.753	132.244	5	15	46.79	1031.99	20	14	49	33.873	141.066	17	51	02.24	811.71
21	13	03	01.997	132.338	5	32	58.78	1029.89	21	14	51	54.939	141.315	18	04	33.95	804.68
22	13	05	14.335	132.436	5	50	08.67	1027.70	22	14	54	16.254	141.566	18	17	58.63	797.53
23	13	07	26.771	132.539	-	6 07	16.37	1025.39	23	14	56	37.820	141.817	-18	31	16.16	-790.31
September 7									September 9								
0	13	09	39.310	132.647	-	6 24	21.76	1022.97	0	14	58	59.637	142.069	-18	44	26.47	-782.99
1	13	11	51.957	132.759	6	41	24.73	1020.44	1	15	01	21.706	142.321	18	57	29.46	775.59
2	13	14	04.716	132.875	6	58	25.17	1017.80	2	15	03	44.027	142.574	19	10	25.05	768.09
3	13	16	17.591	132.996	7	15	22.97	1015.05	3	15	06	06.601	142.828	19	23	13.14	760.51
4	13	18	30.587	133.121	7	32	18.02	1012.19	4	15	08	29.429	143.082	19	35	53.65	752.84
5	13	20	43.708	133.251	7	49	10.21	1009.22	5	15	10	52.511	143.335	19	48	26.49	745.09
6	13	22	56.959	133.384	8	05	59.43	1006.15	6	15	13	15.846	143.589	20	00	51.58	737.24
7	13	25	10.343	133.523	8	22	45.58	1002.97	7	15	15	39.435	143.842	20	13	08.82	729.32
8	13	27	23.866	133.665	8	39	28.55	999.66	8	15	18	03.277	144.096	20	25	18.14	721.31
9	13	29	37.531	133.811	8	56	08.21	996.27	9	15	20	27.373	144.348	20	37	19.45	713.21
10	13	31	51.342	133.962	9	12	44.48	992.76	10	15	22	51.721	144.600	20	49	12.66	705.05
11	13	34	05.304	134.117	9	29	17.24	989.13	11	15	25	16.321	144.851	21	00	57.71	696.78
12	13	36	19.421	134.275	9	45	46.37	985.42	12	15	27	41.172	145.102	21	12	34.49	688.46
13	13	38	33.696	134.438	10	02	11.79	981.58	13	15	30	06.274	145.351	21	24	02.95	680.04
14	13	40	48.134	134.604	10	18	33.37	977.64	14	15	32	31.625	145.598	21	35	22.99	671.54
15	13	43	02.738	134.775	10	34	51.01	973.59	15	15	34	57.223	145.845	21	46	34.53	662.98
16	13	45	17.513	134.949	10	51	04.60	969.44	16	15	37	23.068	146.090	21	57	37.51	654.33
17	13	47	32.462	135.127	11	07	14.04	965.19	17	15	39	49.158	146.333	22	08	31.84	645.61
18	13	49	47.589	135.309	11	23	19.23	960.82	18	15	42	15.491	146.575	22	19	17.45	636.82
19	13	52	02.898	135.494	11	39	20.05	956.36	19	15	44	42.066	146.813	22	29	54.27	627.95
20	13	54	18.392	135.682	11	55	16.41	951.78	20	15	47	08.879	147.051	22	40	22.22	619.01
21	13	56	34.074	135.875	12	11	08.19	947.10	21	15	49	35.930	147.286	22	50	41.23	610.00
22	13	58	49.949	136.071	12	26	55.29	942.32	22	15	52	03.216	147.517	23	00	51.23	600.92
23	14	01	06.020	136.270	12	42	37.61	937.44	23	15	54	30.733	147.747	23	10	52.15	591.77
24	14	03	22.290	136.472	-12	58	15.05		24	15	56	58.480		-23	20	43.92	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
September 10			September 12		
h	h m s	° ' "	h	h m s	° ' "
0	15 56 58.480	-23 20 43.92	0	17 58 10.176	-27 58 24.43
1	15 59 26.454	23 30 26.48	1	18 00 42.880	27 59 54.58
2	16 01 54.652	23 39 59.76	2	18 03 15.511	28 01 14.12
3	16 04 23.070	23 49 23.70	3	18 05 48.061	28 02 23.04
4	16 06 51.705	23 58 38.22	4	18 08 20.522	28 03 21.38
5	16 09 20.554	24 07 43.28	5	18 10 52.886	28 04 09.15
6	16 11 49.614	24 16 38.80	6	18 13 25.145	28 04 46.38
7	16 14 18.879	24 25 24.74	7	18 15 57.292	28 05 13.07
8	16 16 48.347	24 34 01.02	8	18 18 29.319	28 05 29.26
9	16 19 18.013	24 42 27.60	9	18 21 01.218	28 05 34.97
10	16 21 47.872	24 50 44.42	10	18 23 32.980	28 05 30.23
11	16 24 17.922	24 58 51.43	11	18 26 04.600	28 05 15.06
12	16 26 48.156	25 06 48.56	12	18 28 36.069	28 04 49.51
13	16 29 18.571	25 14 35.79	13	18 31 07.379	28 04 13.59
14	16 31 49.160	25 22 13.04	14	18 33 38.523	28 03 27.34
15	16 34 19.921	25 29 40.28	15	18 36 09.494	28 02 30.81
16	16 36 50.846	25 36 57.46	16	18 38 40.284	28 01 24.01
17	16 39 21.931	25 44 04.53	17	18 41 10.886	28 00 07.00
18	16 41 53.170	25 51 01.46	18	18 43 41.293	27 58 39.82
19	16 44 24.558	25 57 48.19	19	18 46 11.497	27 57 02.50
20	16 46 56.090	26 04 24.69	20	18 48 41.493	27 55 15.08
21	16 49 27.758	26 10 50.93	21	18 51 11.272	27 53 17.62
22	16 51 59.557	26 17 06.86	22	18 53 40.829	27 51 10.15
23	16 54 31.482	-26 23 12.45	23	18 56 10.156	-27 48 52.72
September 11			September 13		
h	h m s	° ' "	h	h m s	° ' "
0	16 57 03.525	-26 29 07.66	0	18 58 39.247	-27 46 25.39
1	16 59 35.681	26 34 52.47	1	19 01 08.095	27 43 48.20
2	17 02 07.942	26 40 26.84	2	19 03 36.694	27 41 01.20
3	17 04 40.303	26 45 50.75	3	19 06 05.038	27 38 04.45
4	17 07 12.757	26 51 04.17	4	19 08 33.120	27 34 58.00
5	17 09 45.296	26 56 07.07	5	19 11 00.935	27 31 41.90
6	17 12 17.915	27 00 59.44	6	19 13 28.477	27 28 16.21
7	17 14 50.605	27 05 41.25	7	19 15 55.740	27 24 40.98
8	17 17 23.360	27 10 12.47	8	19 18 22.719	27 20 56.29
9	17 19 56.173	27 14 33.10	9	19 20 49.407	27 17 02.17
10	17 22 29.036	27 18 43.12	10	19 23 15.800	27 12 58.70
11	17 25 01.942	27 22 42.51	11	19 25 41.892	27 08 45.94
12	17 27 34.883	27 26 31.26	12	19 28 07.679	27 04 23.94
13	17 30 07.853	27 30 09.36	13	19 30 33.155	26 59 52.78
14	17 32 40.843	27 33 36.80	14	19 32 58.316	26 55 12.51
15	17 35 13.846	27 36 53.58	15	19 35 23.157	26 50 23.20
16	17 37 46.854	27 39 59.69	16	19 37 47.673	26 45 24.93
17	17 40 19.860	27 42 55.12	17	19 40 11.860	26 40 17.74
18	17 42 52.856	27 45 39.88	18	19 42 35.715	26 35 01.72
19	17 45 25.833	27 48 13.97	19	19 44 59.232	26 29 36.93
20	17 47 58.785	27 50 37.38	20	19 47 22.409	26 24 03.45
21	17 50 31.703	27 52 50.13	21	19 49 45.241	26 18 21.33
22	17 53 04.579	27 54 52.21	22	19 52 07.725	26 12 30.65
23	17 55 37.406	27 56 43.64	23	19 54 29.856	26 06 31.49
24	17 58 10.176	-27 58 24.43	24	19 56 51.633	-26 00 23.91

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
September 14			September 16		
0	19 56 51.633 141.419	-26 00 23.91 +375.93	0	21 42 50.451 123.228	-18 46 20.24 +685.88
1	19 59 13.052 141.057	25 54 07.98 384.19	1	21 44 53.679 122.877	18 34 54.36 690.47
2	20 01 34.109 140.694	25 47 43.79 392.38	2	21 46 56.556 122.526	18 23 23.89 694.97
3	20 03 54.803 140.327	25 41 11.41 400.51	3	21 48 59.082 122.178	18 11 48.92 699.39
4	20 06 15.130 139.958	25 34 30.90 408.56	4	21 51 01.260 121.835	18 00 09.53 703.76
5	20 08 35.088 139.586	25 27 42.34 416.53	5	21 53 03.095 121.492	17 48 25.77 708.04
6	20 10 54.674 139.212	25 20 45.81 424.42	6	21 55 04.587 121.154	17 36 37.73 712.26
7	20 13 13.886 138.836	25 13 41.39 432.24	7	21 57 05.741 120.817	17 24 45.47 716.39
8	20 15 32.722 138.459	25 06 29.15 439.99	8	21 59 06.558 120.484	17 12 49.08 720.47
9	20 17 51.181 138.079	24 59 09.16 447.66	9	22 01 07.042 120.154	17 00 48.61 724.47
10	20 20 09.260 137.697	24 51 41.50 455.24	10	22 03 07.196 119.827	16 48 44.14 728.40
11	20 22 26.957 137.315	24 44 06.26 462.76	11	22 05 07.023 119.502	16 36 35.74 732.25
12	20 24 44.272 136.930	24 36 23.50 470.19	12	22 07 06.525 119.182	16 24 23.49 736.05
13	20 27 01.202 136.545	24 28 33.31 477.55	13	22 09 05.707 118.864	16 12 07.44 739.77
14	20 29 17.747 136.158	24 20 35.76 484.84	14	22 11 04.571 118.549	15 59 47.67 743.42
15	20 31 33.905 135.771	24 12 30.92 492.03	15	22 13 03.120 118.238	15 47 24.25 747.00
16	20 33 49.676 135.383	24 04 18.89 499.15	16	22 15 01.358 117.930	15 34 57.25 750.52
17	20 36 05.059 134.993	23 55 59.74 506.21	17	22 16 59.288 117.625	15 22 26.73 753.96
18	20 38 20.052 134.604	23 47 33.53 513.16	18	22 18 56.913 117.324	15 09 52.77 757.35
19	20 40 34.656 134.214	23 39 00.37 520.06	19	22 20 54.237 117.027	14 57 15.42 760.66
20	20 42 48.870 133.823	23 30 20.31 526.87	20	22 22 51.264 116.731	14 44 34.76 763.90
21	20 45 02.693 133.433	23 21 33.44 533.59	21	22 24 47.995 116.441	14 31 50.86 767.08
22	20 47 16.126 133.042	23 12 39.85 540.25	22	22 26 44.436 116.154	14 19 03.78 770.20
23	20 49 29.168 132.652	-23 03 39.60 +546.82	23	22 28 40.590 115.869	-14 06 13.58 +773.25
September 15			September 17		
0	20 51 41.820 132.262	-22 54 32.78 +553.32	0	22 30 36.459 115.589	-13 53 20.33 +776.23
1	20 53 54.082 131.871	22 45 19.46 559.73	1	22 32 32.048 115.313	13 40 24.10 779.15
2	20 56 05.953 131.482	22 35 59.73 566.07	2	22 34 27.361 115.039	13 27 24.95 782.00
3	20 58 17.435 131.093	22 26 33.66 572.32	3	22 36 22.400 114.770	13 14 22.95 784.80
4	21 00 28.528 130.705	22 17 01.34 578.51	4	22 38 17.170 114.505	13 01 18.15 787.52
5	21 02 39.233 130.317	22 07 22.83 584.61	5	22 40 11.675 114.242	12 48 10.63 790.19
6	21 04 49.550 129.930	21 57 38.22 590.63	6	22 42 05.917 113.984	12 35 00.44 792.79
7	21 06 59.480 129.545	21 47 47.59 596.58	7	22 43 59.901 113.729	12 21 47.65 795.33
8	21 09 09.025 129.160	21 37 51.01 602.44	8	22 45 53.630 113.479	12 08 32.32 797.80
9	21 11 18.185 128.776	21 27 48.57 608.24	9	22 47 47.109 113.232	11 55 14.52 800.23
10	21 13 26.961 128.394	21 17 40.33 613.94	10	22 49 40.341 112.988	11 41 54.29 802.57
11	21 15 35.355 128.014	21 07 26.39 619.58	11	22 51 33.329 112.749	11 28 31.72 804.88
12	21 17 43.369 127.634	20 57 06.81 625.14	12	22 53 26.078 112.514	11 15 06.84 807.10
13	21 19 51.003 127.256	20 46 41.67 630.62	13	22 55 18.592 112.282	11 01 39.74 809.28
14	21 21 58.259 126.880	20 36 11.05 636.02	14	22 57 10.874 112.054	10 48 10.46 811.39
15	21 24 05.139 126.506	20 25 35.03 641.34	15	22 59 02.928 111.831	10 34 39.07 813.44
16	21 26 11.645 126.133	20 14 53.69 646.60	16	23 00 54.759 111.610	10 21 05.63 815.44
17	21 28 17.778 125.763	20 04 07.09 651.77	17	23 02 46.369 111.394	10 07 30.19 817.38
18	21 30 23.541 125.394	19 53 15.32 656.87	18	23 04 37.763 111.183	9 53 52.81 819.26
19	21 32 28.935 125.027	19 42 18.45 661.90	19	23 06 28.946 110.974	9 40 13.55 821.07
20	21 34 33.962 124.663	19 31 16.55 666.84	20	23 08 19.920 110.769	9 26 32.48 822.84
21	21 36 38.625 124.301	19 20 09.71 671.71	21	23 10 10.689 110.570	9 12 49.64 824.54
22	21 38 42.926 123.941	19 08 58.00 676.52	22	23 12 01.259 110.373	8 59 05.10 826.19
23	21 40 46.867 123.584	18 57 41.48 +681.24	23	23 13 51.632 110.180	8 45 18.91 +827.78
24	21 42 50.451	-18 46 20.24	24	23 15 41.812	- 8 31 31.13

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination			
September 18							September 20							
h	h	m	s	°	'	"	h	h	m	s	°	'	"	
0	23	15	41.812	109.992	-	8 31 31.13	+829.32	0	04	22.916	105.670	+	2 44 36.99	+842.20
1	23	17	31.804	109.808		8 17 41.81	830.80	1	04	08.586	105.678		2 58 39.19	841.29
2	23	19	21.612	109.628		8 03 51.01	832.22	2	04	54.264	105.690		3 12 40.48	840.34
3	23	21	11.240	109.451		7 49 58.79	833.59	3	04	39.954	105.705		3 26 40.82	839.33
4	23	23	00.691	109.278		7 36 05.20	834.90	4	04	25.659	105.724		3 40 40.15	838.28
5	23	24	49.969	109.110		7 22 10.30	836.16	5	05	11.383	105.748		3 54 38.43	837.18
6	23	26	39.079	108.946		7 08 14.14	837.37	6	05	57.131	105.775		4 08 35.61	836.05
7	23	28	28.025	108.785		6 54 16.77	838.51	7	05	42.906	105.806		4 22 31.66	834.86
8	23	30	16.810	108.629		6 40 18.26	839.61	8	05	28.712	105.841		4 36 26.52	833.64
9	23	32	05.439	108.477		6 26 18.65	840.66	9	05	14.553	105.880		4 50 20.16	832.35
10	23	33	53.916	108.328		6 12 17.99	841.65	10	05	00.433	105.923		5 04 12.51	831.04
11	23	35	42.244	108.184		5 58 16.34	842.58	11	06	46.356	105.969		5 18 03.55	829.67
12	23	37	30.428	108.044		5 44 13.76	843.46	12	06	32.325	106.020		5 31 53.22	828.26
13	23	39	18.472	107.907		5 30 10.30	844.30	13	06	18.345	106.074		5 45 41.48	826.80
14	23	41	06.379	107.776		5 16 06.00	845.08	14	06	04.419	106.132		5 59 28.28	825.31
15	23	42	54.155	107.647		5 02 00.92	845.81	15	07	50.551	106.194		6 13 13.59	823.75
16	23	44	41.802	107.523		4 47 55.11	846.48	16	07	36.745	106.260		6 26 57.34	822.17
17	23	46	29.325	107.403		4 33 48.63	847.11	17	08	23.005	106.329		6 40 39.51	820.53
18	23	48	16.728	107.287		4 19 41.52	847.68	18	08	09.334	106.403		6 54 20.04	818.84
19	23	50	04.015	107.175		4 05 33.84	848.21	19	08	55.737	106.480		7 07 58.88	817.13
20	23	51	51.190	107.066		3 51 25.63	848.68	20	09	42.217	106.561		7 21 36.01	815.35
21	23	53	38.256	106.963		3 37 16.95	849.10	21	10	28.778	106.646		7 35 11.36	813.53
22	23	55	25.219	106.863		3 23 07.85	849.47	22	10	15.424	106.734		7 48 44.89	811.67
23	23	57	12.082	106.767		- 3 08 58.38	+849.79	23	11	02.158	106.826	+	8 02 16.56	+809.77
September 19							September 21							
0	23	58	58.849	106.676	-	2 54 48.59	+850.07	0	12	48.984	106.923	+	8 15 46.33	+807.81
1	00	00	45.525	106.587		2 40 38.52	850.29	1	12	35.907	107.022		8 29 14.14	805.82
2	00	02	32.112	106.503		2 26 28.23	850.47	2	12	22.929	107.126		8 42 39.96	803.77
3	00	04	18.615	106.424		2 12 17.76	850.59	3	12	10.055	107.233		8 56 03.73	801.69
4	00	06	05.039	106.348		1 58 07.17	850.66	4	12	30.57288	107.343		9 09 25.42	799.56
5	00	07	51.387	106.276		1 43 56.51	850.70	5	12	44.631	107.459		9 22 44.98	797.37
6	00	09	37.663	106.209		1 29 45.81	850.67	6	12	34.32090	107.576		9 36 02.35	795.16
7	00	11	23.872	106.144		1 15 35.14	850.60	7	12	36.19666	107.699		9 49 17.51	792.88
8	00	13	10.016	106.085		1 01 24.54	850.49	8	12	38.07365	107.824		10 02 30.39	790.57
9	00	14	56.101	106.029		0 47 14.05	850.32	9	12	39.55189	107.954		10 15 40.96	788.21
10	00	16	42.130	105.978		0 33 03.73	850.11	10	12	41.43143	108.086		10 28 49.17	785.81
11	00	18	28.108	105.929		0 18 53.62	849.85	11	12	43.31229	108.223		10 41 54.98	783.35
12	00	20	14.037	105.886	-	0 04 43.77	849.54	12	12	45.19452	108.363		10 54 58.33	780.86
13	00	21	59.923	105.846	+	0 09 25.77	849.18	13	12	47.07815	108.506		11 07 59.19	778.32
14	00	23	45.769	105.810		0 23 34.95	848.79	14	12	48.56321	108.654		11 20 57.51	775.72
15	00	25	31.579	105.779		0 37 43.74	848.33	15	12	50.44975	108.804		11 33 53.23	773.09
16	00	27	17.358	105.751		0 51 52.07	847.84	16	12	52.33779	108.959		11 46 46.32	770.41
17	00	29	03.109	105.726		1 05 59.91	847.30	17	12	54.22738	109.117		11 59 36.73	767.68
18	00	30	48.835	105.707		1 20 07.21	846.70	18	12	56.11855	109.278		12 12 24.41	764.91
19	00	32	34.542	105.691		1 34 13.91	846.07	19	12	58.01133	109.443		12 25 09.32	762.08
20	00	34	20.233	105.679		1 48 19.98	845.39	20	12	59.50576	109.611		12 37 51.40	759.22
21	00	36	05.912	105.671		2 02 25.37	844.67	21	12	01.40187	109.783		12 50 30.62	756.31
22	00	37	51.583	105.667		2 16 30.04	843.88	22	12	03.29970	109.959		13 03 06.93	753.34
23	00	39	37.250	105.666		2 30 33.92	+843.07	23	12	05.19929	110.137	+	13 15 40.27	+750.34
24	00	41	22.916		+	2 44 36.99		24	12	07.10066		+	13 28 10.61	+750.34

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
September 22									September 24								
h	h	m	s	s	°	'	"	"	h	h	m	s	s	°	'	"	"
0	2	07	10.066	110.319	+13	28	10.61	+747.28	0	3	39	46.690	122.446	+22	13	26.07	+541.81
1	2	09	00.385	110.504	13	40	37.89	744.17	1	3	41	49.136	122.751	22	22	27.88	536.23
2	2	10	50.889	110.693	13	53	02.06	741.03	2	3	43	51.887	123.058	22	31	24.11	530.60
3	2	12	41.582	110.885	14	05	23.09	737.83	3	3	45	54.945	123.366	22	40	14.71	524.90
4	2	14	32.467	111.081	14	17	40.92	734.58	4	3	47	58.311	123.675	22	48	59.61	519.16
5	2	16	23.548	111.279	14	29	55.50	731.29	5	3	50	01.986	123.984	22	57	38.77	513.35
6	2	18	14.827	111.481	14	42	06.79	727.95	6	3	52	05.970	124.296	23	06	12.12	507.49
7	2	20	06.308	111.686	14	54	14.74	724.56	7	3	54	10.266	124.607	23	14	39.61	501.57
8	2	21	57.994	111.894	15	06	19.30	721.12	8	3	56	14.873	124.920	23	23	01.18	495.61
9	2	23	49.888	112.106	15	18	20.42	717.63	9	3	58	19.793	125.233	23	31	16.79	489.57
10	2	25	41.994	112.321	15	30	18.05	714.10	10	4	00	25.026	125.546	23	39	26.36	483.49
11	2	27	34.315	112.539	15	42	12.15	710.51	11	4	02	30.572	125.860	23	47	29.85	477.34
12	2	29	26.854	112.759	15	54	02.66	706.88	12	4	04	36.432	126.175	23	55	27.19	471.15
13	2	31	19.613	112.983	16	05	49.54	703.20	13	4	06	42.607	126.490	24	03	18.34	464.88
14	2	33	12.596	113.211	16	17	32.74	699.46	14	4	08	49.097	126.804	24	11	03.22	458.58
15	2	35	05.807	113.440	16	29	12.20	695.69	15	4	10	55.901	127.120	24	18	41.80	452.21
16	2	36	59.247	113.673	16	40	47.89	691.85	16	4	13	03.021	127.435	24	26	14.01	445.78
17	2	38	52.920	113.909	16	52	19.74	687.97	17	4	15	10.456	127.750	24	33	39.79	439.30
18	2	40	46.829	114.148	17	03	47.71	684.03	18	4	17	18.206	128.065	24	40	59.09	432.76
19	2	42	40.977	114.390	17	15	11.74	680.06	19	4	19	26.271	128.379	24	48	11.85	426.16
20	2	44	35.367	114.634	17	26	31.80	676.02	20	4	21	34.650	128.694	24	55	18.01	419.51
21	2	46	30.001	114.881	17	37	47.82	671.94	21	4	23	43.344	129.008	25	02	17.52	412.80
22	2	48	24.882	115.132	17	48	59.76	667.80	22	4	25	52.352	129.321	25	09	10.32	406.03
23	2	50	20.014	115.384	+18	00	07.56	+663.62	23	4	28	01.673	129.634	+25	15	56.35	+399.21
September 23									September 25								
0	2	52	15.398	115.639	+18	11	11.18	+659.38	0	4	30	11.307	129.946	+25	22	35.56	+392.33
1	2	54	11.037	115.898	18	22	10.56	655.10	1	4	32	21.253	130.257	25	29	07.89	385.39
2	2	56	06.935	116.158	18	33	05.66	650.75	2	4	34	31.510	130.568	25	35	33.28	378.41
3	2	58	03.093	116.421	18	43	56.41	646.36	3	4	36	42.078	130.876	25	41	51.69	371.35
4	2	59	59.514	116.687	18	54	42.77	641.92	4	4	38	52.954	131.185	25	48	03.04	364.25
5	3	01	56.201	116.956	19	05	24.69	637.42	5	4	41	04.139	131.492	25	54	07.29	357.10
6	3	03	53.157	117.225	19	16	02.11	632.87	6	4	43	15.631	131.797	26	00	04.39	349.87
7	3	05	50.382	117.499	19	26	34.98	628.27	7	4	45	27.428	132.101	26	05	54.26	342.61
8	3	07	47.881	117.774	19	37	03.25	623.62	8	4	47	39.529	132.404	26	11	36.87	335.28
9	3	09	45.655	117.974	19	47	26.87	618.90	9	4	49	51.933	132.704	26	17	12.15	327.90
10	3	11	43.706	118.331	19	57	45.77	614.15	10	4	52	04.637	133.004	26	22	40.05	320.47
11	3	13	42.037	118.613	20	07	59.92	609.34	11	4	54	17.641	133.301	26	28	00.52	312.98
12	3	15	40.650	118.897	20	18	09.26	604.46	12	4	56	30.942	133.597	26	33	13.50	305.43
13	3	17	39.547	119.182	20	28	13.72	599.55	13	4	58	44.539	133.889	26	38	18.93	297.84
14	3	19	38.729	119.471	20	38	13.27	594.57	14	5	00	58.428	134.181	26	43	16.77	290.19
15	3	21	38.200	119.760	20	48	07.84	589.54	15	5	03	12.609	134.470	26	48	06.96	282.48
16	3	23	37.960	120.053	20	57	57.38	584.45	16	5	05	27.079	134.756	26	52	49.44	274.72
17	3	25	38.013	120.345	21	07	41.83	579.32	17	5	07	41.835	135.040	26	57	24.16	266.92
18	3	27	38.358	120.641	21	17	21.15	574.12	18	5	09	56.875	135.321	27	01	51.08	259.05
19	3	29	38.999	120.938	21	26	55.27	568.88	19	5	12	12.196	135.600	27	06	10.13	251.14
20	3	31	39.937	121.237	21	36	24.15	563.57	20	5	14	27.796	135.875	27	10	21.27	243.18
21	3	33	41.174	121.537	21	45	47.72	558.22	21	5	16	43.671	136.149	27	14	24.45	235.16
22	3	35	42.711	121.838	21	55	05.94	552.80	22	5	18	59.820	136.418	27	18	19.61	227.10
23	3	37	44.549	122.141	22	04	18.74	+547.33	23	5	21	16.238	136.686	27	22	06.71	+218.98
24	3	39	46.690		+22	13	26.07		24	5	23	32.924		+27	25	45.69	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
September 26									September 28								
h	h	m	s		°	'	"		h	h	m	s		°	'	"	
0	5	23	32.924		+27	25	45.69	+210.81	0	7	16	44.829		+27	28	26.63	-224.52
1	5	25	49.873	136.949	27	29	16.50	202.60	1	7	19	09.084	144.255	27	24	42.11	234.10
2	5	28	07.082	137.209	27	32	39.10	194.34	2	7	21	33.361	144.277	27	20	48.01	243.68
3	5	30	24.548	137.466	27	35	53.44	186.03	3	7	23	57.653	144.292	27	16	44.33	253.27
4	5	32	42.267	137.719	27	38	59.47	177.68	4	7	26	21.956	144.303	27	12	31.06	262.81
5	5	35	00.236	137.969	27	41	57.15	169.27	5	7	28	46.264	144.308	27	08	08.22	272.43
6	5	37	18.451	138.215	27	44	46.42	160.82	6	7	31	10.572	144.308	27	03	35.79	282.00
7	5	39	36.908	138.457	27	47	27.24	152.32	7	7	33	34.875	144.303	26	58	53.79	291.57
8	5	41	55.604	138.696	27	49	59.56	143.79	8	7	35	59.166	144.291	26	54	02.22	301.14
9	5	44	14.534	138.930	27	52	23.35	135.20	9	7	38	23.441	144.275	26	49	01.08	310.69
10	5	46	33.694	139.160	27	54	38.55	126.58	10	7	40	47.696	144.255	26	43	50.39	320.25
11	5	48	53.080	139.386	27	56	45.13	117.91	11	7	43	11.924	144.228	26	38	30.14	329.78
12	5	51	12.688	139.608	27	58	43.04	109.20	12	7	45	36.120	144.196	26	33	00.36	339.31
13	5	53	32.514	139.826	28	00	32.24	100.44	13	7	48	00.281	144.161	26	27	21.05	348.83
14	5	55	52.552	140.038	28	02	12.68	91.66	14	7	50	24.400	144.119	26	21	32.22	358.33
15	5	58	12.799	140.247	28	03	44.34	82.82	15	7	52	48.473	144.073	26	15	33.89	367.82
16	6	00	33.250	140.451	28	05	07.16	73.95	16	7	55	12.496	144.023	26	09	26.07	377.30
17	6	02	53.901	140.651	28	06	21.11	65.05	17	7	57	36.463	143.967	26	03	08.77	386.74
18	6	05	14.746	140.845	28	07	26.16	56.10	18	8	00	00.371	143.908	25	56	42.03	396.18
19	6	07	35.780	141.034	28	08	22.26	47.11	19	8	02	24.214	143.843	25	50	05.85	405.60
20	6	09	57.000	141.220	28	09	09.37	38.11	20	8	04	47.987	143.773	25	43	20.25	414.98
21	6	12	18.399	141.399	28	09	47.48	29.05	21	8	07	11.688	143.701	25	36	25.27	424.37
22	6	14	39.974	141.575	28	10	16.53	19.96	22	8	09	35.311	143.623	25	29	20.90	433.70
23	6	17	01.718	141.744	+28	10	36.49	+10.85	23	8	11	58.853	143.542	+25	22	07.20	-443.03
			141.910									143.456					
September 27									September 29								
0	6	19	23.628	142.068	+28	10	47.34	+1.71	0	8	14	22.309	143.366	+25	14	44.17	-452.33
1	6	21	45.696	142.224	28	10	49.05	7.48	1	8	16	45.675	143.273	25	07	11.84	461.59
2	6	24	07.920	142.372	28	10	41.57	16.68	2	8	19	08.948	143.175	24	59	30.25	470.84
3	6	26	30.292	142.516	28	10	24.89	25.92	3	8	21	32.123	143.074	24	51	39.41	480.04
4	6	28	52.808	142.654	28	09	58.97	35.19	4	8	23	55.197	142.970	24	43	39.37	489.22
5	6	31	15.462	142.788	28	09	23.78	44.47	5	8	26	18.167	142.862	24	35	30.15	498.36
6	6	33	38.250	142.914	28	08	39.31	53.79	6	8	28	41.029	142.750	24	27	11.79	507.48
7	6	36	01.164	143.037	28	07	45.52	63.13	7	8	31	03.779	142.636	24	18	44.31	516.55
8	6	38	24.201	143.154	28	06	42.39	72.50	8	8	33	26.415	142.518	24	10	07.76	525.60
9	6	40	47.355	143.264	28	05	29.89	81.88	9	8	35	48.933	142.398	24	01	22.16	534.59
10	6	43	10.619	143.370	28	04	08.01	91.28	10	8	38	11.331	142.273	23	52	27.57	543.56
11	6	45	33.989	143.469	28	02	36.73	100.71	11	8	40	33.604	142.148	23	43	24.01	552.48
12	6	47	57.458	143.564	28	00	56.02	110.16	12	8	42	55.752	142.018	23	34	11.53	561.37
13	6	50	21.022	143.652	27	59	05.86	119.61	13	8	45	17.770	141.887	23	24	50.16	570.20
14	6	52	44.674	143.735	27	57	06.25	129.10	14	8	47	39.657	141.752	23	15	19.96	579.01
15	6	55	08.409	143.813	27	54	57.15	138.59	15	8	50	01.409	141.616	23	05	40.95	587.75
16	6	57	32.222	143.884	27	52	38.56	148.10	16	8	52	23.025	141.477	22	55	53.20	596.46
17	6	59	56.106	143.950	27	50	10.46	157.61	17	8	54	44.502	141.336	22	45	56.74	605.12
18	7	02	20.056	144.011	27	47	32.85	167.15	18	8	57	05.838	141.194	22	35	51.62	613.74
19	7	04	44.067	144.065	27	44	45.70	176.70	19	8	59	27.032	141.048	22	25	37.88	622.29
20	7	07	08.132	144.114	27	41	49.00	186.24	20	9	01	48.080	140.903	22	15	15.59	630.81
21	7	09	32.246	144.158	27	38	42.76	195.81	21	9	04	08.983	140.754	22	04	44.78	639.27
22	7	11	56.404	144.196	27	35	26.95	205.37	22	9	06	29.737	140.605	21	54	05.51	647.68
23	7	14	20.600	144.229	27	32	01.58	214.95	23	9	08	50.342	140.454	21	43	17.83	656.03
24	7	16	44.829		+27	28	26.63		24	9	11	10.796		+21	32	21.80	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent		Hour	Apparent	
	Right Ascension			Right Ascension	
	Declination			Declination	
September 30					
h	h m s	° ' "	h	h m s	° ' "
0	9 11 10.796	+21 32 21.80	0	11 00 36.137	+10 25 33.04
1	9 13 31.098	21 21 17.47	1	11 02 49.803	10 09 14.15
2	9 15 51.246	21 10 04.89	2	11 05 03.384	9 52 50.81
3	9 18 11.240	20 58 44.13	3	11 07 16.883	9 36 23.13
4	9 20 31.078	20 47 15.23	4	11 09 30.305	9 19 51.21
5	9 22 50.760	20 35 38.27	5	11 11 43.653	9 03 15.16
6	9 25 10.286	20 23 53.30	6	11 13 56.930	8 46 35.07
7	9 27 29.654	20 12 00.38	7	11 16 10.141	8 29 51.05
8	9 29 48.864	19 59 59.57	8	11 18 23.290	8 13 03.20
9	9 32 07.916	19 47 50.94	9	11 20 36.379	7 56 11.62
10	9 34 26.810	19 35 34.54	10	11 22 49.413	7 39 16.42
11	9 36 45.545	19 23 10.46	11	11 25 02.396	7 22 17.71
12	9 39 04.122	19 10 38.74	12	11 27 15.332	7 05 15.59
13	9 41 22.540	18 57 59.47	13	11 29 28.225	6 48 10.16
14	9 43 40.800	18 45 12.70	14	11 31 41.080	6 31 01.55
15	9 45 58.903	18 32 18.51	15	11 33 53.899	6 13 49.84
16	9 48 16.848	18 19 16.97	16	11 36 06.687	5 56 35.16
17	9 50 34.636	18 06 08.14	17	11 38 19.450	5 39 17.61
18	9 52 52.268	17 52 52.10	18	11 40 32.190	5 21 57.30
19	9 55 09.745	17 39 28.93	19	11 42 44.912	5 04 34.35
20	9 57 27.068	17 25 58.69	20	11 44 57.620	4 47 08.86
21	9 59 44.237	17 12 21.47	21	11 47 10.319	4 29 40.94
22	10 02 01.254	16 58 37.33	22	11 49 23.014	4 12 10.72
23	10 04 18.120	+16 44 46.36	23	11 51 35.708	+3 54 38.29
	136.716	-837.73		132.698	-1054.51
October 1					
0	10 06 34.836	+16 30 48.63	0	11 53 48.406	+3 37 03.78
1	10 08 51.404	16 16 44.22	1	11 56 01.112	3 19 27.30
2	10 11 07.825	16 02 33.21	2	11 58 13.832	3 01 48.97
3	10 13 24.100	15 48 15.68	3	12 00 26.568	2 44 08.89
4	10 15 40.232	15 33 51.71	4	12 02 39.327	2 26 27.19
5	10 17 56.223	15 19 21.39	5	12 04 52.113	2 08 43.99
6	10 20 12.073	15 04 44.79	6	12 07 04.930	1 50 59.39
7	10 22 27.786	14 50 02.00	7	12 09 17.782	1 33 13.51
8	10 24 43.362	14 35 13.11	8	12 11 30.675	1 15 26.48
9	10 26 58.805	14 20 18.20	9	12 13 43.613	0 57 38.42
10	10 29 14.117	14 05 17.36	10	12 15 56.601	0 39 49.43
11	10 31 29.300	13 50 10.68	11	12 18 09.643	0 21 59.65
12	10 33 44.356	13 34 58.23	12	12 20 22.744	+0 04 09.19
13	10 35 59.287	13 19 40.12	13	12 22 35.909	-0 13 41.84
14	10 38 14.098	13 04 16.43	14	12 24 49.142	0 31 33.30
15	10 40 28.789	12 48 47.25	15	12 27 02.448	0 49 25.08
16	10 42 43.364	12 33 12.68	16	12 29 15.832	1 07 17.05
17	10 44 57.826	12 17 32.80	17	12 31 29.298	1 25 09.10
18	10 47 12.177	12 01 47.71	18	12 33 42.851	1 43 01.11
19	10 49 26.421	11 45 57.50	19	12 35 56.496	2 00 52.94
20	10 51 40.560	11 30 02.27	20	12 38 10.238	2 18 44.47
21	10 53 54.599	11 14 02.12	21	12 40 24.080	2 36 35.59
22	10 56 08.539	10 57 57.13	22	12 42 38.028	2 54 26.18
23	10 58 22.384	10 41 47.40	23	12 44 52.087	3 12 16.09
24	11 00 36.137	+10 25 33.04	24	12 47 06.261	-3 30 05.22
	133.753	-974.36		134.174	-1069.13
October 3					
0	10 06 34.836	+16 30 48.63	0	11 53 48.406	+3 37 03.78
1	10 08 51.404	16 16 44.22	1	11 56 01.112	3 19 27.30
2	10 11 07.825	16 02 33.21	2	11 58 13.832	3 01 48.97
3	10 13 24.100	15 48 15.68	3	12 00 26.568	2 44 08.89
4	10 15 40.232	15 33 51.71	4	12 02 39.327	2 26 27.19
5	10 17 56.223	15 19 21.39	5	12 04 52.113	2 08 43.99
6	10 20 12.073	15 04 44.79	6	12 07 04.930	1 50 59.39
7	10 22 27.786	14 50 02.00	7	12 09 17.782	1 33 13.51
8	10 24 43.362	14 35 13.11	8	12 11 30.675	1 15 26.48
9	10 26 58.805	14 20 18.20	9	12 13 43.613	0 57 38.42
10	10 29 14.117	14 05 17.36	10	12 15 56.601	0 39 49.43
11	10 31 29.300	13 50 10.68	11	12 18 09.643	0 21 59.65
12	10 33 44.356	13 34 58.23	12	12 20 22.744	+0 04 09.19
13	10 35 59.287	13 19 40.12	13	12 22 35.909	-0 13 41.84
14	10 38 14.098	13 04 16.43	14	12 24 49.142	0 31 33.30
15	10 40 28.789	12 48 47.25	15	12 27 02.448	0 49 25.08
16	10 42 43.364	12 33 12.68	16	12 29 15.832	1 07 17.05
17	10 44 57.826	12 17 32.80	17	12 31 29.298	1 25 09.10
18	10 47 12.177	12 01 47.71	18	12 33 42.851	1 43 01.11
19	10 49 26.421	11 45 57.50	19	12 35 56.496	2 00 52.94
20	10 51 40.560	11 30 02.27	20	12 38 10.238	2 18 44.47
21	10 53 54.599	11 14 02.12	21	12 40 24.080	2 36 35.59
22	10 56 08.539	10 57 57.13	22	12 42 38.028	2 54 26.18
23	10 58 22.384	10 41 47.40	23	12 44 52.087	3 12 16.09
24	11 00 36.137	+10 25 33.04	24	12 47 06.261	-3 30 05.22
	133.753	-974.36		134.174	-1069.13

MOON, 1967

FOR EACH HOUR OF EPHEMERIS TIME

137

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination							
October 4							October 6											
h	h	m	s	°	'	"	h	h	m	s	°	'	"					
0	12	47	06.261	134°293	-	3	30	05.22	-1068.21	0	14	38	03.903	144°624	-16	48	50.69	-876.81
1	12	49	20.554	134°418		3	47	53.43	1067.18	1	14	40	28.527	144°905	17	03	27.50	869.82
2	12	51	34.972	134°546		4	05	40.61	1066.01	2	14	42	53.432	145°185	17	17	57.32	862.72
3	12	53	49.518	134°680		4	23	26.62	1064.73	3	14	45	18.617	145°468	17	32	20.04	855.51
4	12	56	04.198	134°818		4	41	11.35	1063.31	4	14	47	44.085	145°749	17	46	35.55	848.20
5	12	58	19.016	134°960		4	58	54.66	1061.77	5	14	50	09.834	146°033	18	00	43.75	840.76
6	13	00	33.976	135°108		5	16	36.43	1060.11	6	14	52	35.867	146°315	18	14	44.51	833.22
7	13	02	49.084	135°258		5	34	16.54	1058.31	7	14	55	02.182	146°598	18	28	37.73	825.56
8	13	05	04.342	135°415		5	51	54.85	1056.40	8	14	57	28.780	146°881	18	42	23.29	817.81
9	13	07	19.757	135°574		6	09	31.25	1054.36	9	14	59	55.661	147°164	18	56	01.10	809.93
10	13	09	35.331	135°740		6	27	05.61	1052.18	10	15	02	22.825	147°446	19	09	31.03	801.96
11	13	11	51.071	135°908		6	44	37.79	1049.89	11	15	04	50.271	147°727	19	22	52.99	793.89
12	13	14	06.979	136°081		7	02	07.68	1047.47	12	15	07	17.998	148°009	19	36	06.88	785.69
13	13	16	23.060	136°259		7	19	35.15	1044.91	13	15	09	46.007	148°288	19	49	12.57	777.41
14	13	18	39.319	136°440		7	37	00.06	1042.24	14	15	12	14.295	148°568	20	02	09.98	769.02
15	13	20	55.759	136°626		7	54	22.30	1039.44	15	15	14	42.863	148°845	20	14	59.00	760.53
16	13	23	12.385	136°816		8	11	41.74	1036.50	16	15	17	11.708	149°122	20	27	39.53	751.94
17	13	25	29.201	137°010		8	28	58.24	1033.45	17	15	19	40.830	149°397	20	40	11.47	743.25
18	13	27	46.211	137°207		8	46	11.69	1030.26	18	15	22	10.227	149°669	20	52	34.72	734.47
19	13	30	03.418	137°410		9	03	21.95	1026.95	19	15	24	39.896	149°941	21	04	49.19	725.58
20	13	32	20.828	137°615		9	20	28.90	1023.52	20	15	27	09.837	150°209	21	16	54.77	716.62
21	13	34	38.443	137°825		9	37	32.42	1019.95	21	15	29	40.046	150°476	21	28	51.39	707.54
22	13	36	56.268	138°038		9	54	32.37	1016.26	22	15	32	10.522	150°741	21	40	38.93	698.38
23	13	39	14.306	138°255		-10	11	28.63	-1012.45	23	15	34	41.263	151°001	-21	52	17.31	-689.14
October 5							October 7											
0	13	41	32.561	138°475		-10	28	21.08	-1008.50	0	15	37	12.264	151°261	-22	03	46.45	-679.80
1	13	43	51.036	138°700		-10	45	09.58	-1004.43	1	15	39	43.525	151°516	22	15	06.25	670.37
2	13	46	09.736	138°927		11	01	54.01	1000.24	2	15	42	15.041	151°768	22	26	16.62	660.86
3	13	48	28.663	139°159		11	18	34.25	995.92	3	15	44	46.809	152°018	22	37	17.48	651.27
4	13	50	47.822	139°392		11	35	10.17	991.47	4	15	47	18.827	152°263	22	48	08.75	641.60
5	13	53	07.214	139°630		11	51	41.64	986.90	5	15	49	51.090	152°504	22	58	50.35	631.83
6	13	55	26.844	139°871		12	08	08.54	982.21	6	15	52	23.594	152°742	23	09	22.18	622.00
7	13	57	46.715	140°114		12	24	30.75	977.39	7	15	54	56.336	152°976	23	19	44.18	612.09
8	14	00	06.829	140°361		12	40	48.14	972.44	8	15	57	29.312	153°204	23	29	56.27	602.10
9	14	02	27.190	140°611		12	57	00.58	967.37	9	16	00	02.516	153°430	23	39	58.37	592.04
10	14	04	47.801	140°862		13	13	07.95	962.18	10	16	02	35.946	153°649	23	49	50.41	581.90
11	14	07	08.663	141°118		13	29	10.13	956.87	11	16	05	09.595	153°865	23	59	32.31	571.71
12	14	09	29.781	141°375		13	45	07.00	951.43	12	16	07	43.460	154°075	24	09	04.02	561.42
13	14	11	51.156	141°636		14	00	58.43	945.87	13	16	10	17.535	154°280	24	18	25.44	551.09
14	14	14	12.792	141°897		14	16	44.30	940.19	14	16	12	51.815	154°479	24	27	36.53	540.69
15	14	16	34.689	142°162		14	32	24.49	934.38	15	16	15	26.294	154°673	24	36	37.22	530.22
16	14	18	56.851	142°429		14	47	58.87	928.46	16	16	18	00.967	154°862	24	45	27.44	519.70
17	14	21	19.280	142°698		15	03	27.33	922.42	17	16	20	35.829	155°043	24	54	07.14	509.11
18	14	23	41.978	142°968		15	18	49.75	916.26	18	16	23	10.872	155°220	25	02	36.25	498.47
19	14	26	04.946	143°240		15	34	06.01	909.97	19	16	25	46.092	155°390	25	10	54.72	487.78
20	14	28	28.186	143°515		15	49	15.98	903.57	20	16	28	21.482	155°554	25	19	02.50	477.93
21	14	30	51.701	143°790		16	04	19.55	897.06	21	16	30	57.036	155°711	25	26	59.53	466.22
22	14	33	15.491	144°067		16	19	16.61	890.42	22	16	33	32.747	155°861	25	34	45.75	455.39
23	14	35	39.558	144°345		16	34	07.03	-883.66	23	16	36	08.608	156°004	25	42	21.14	-444.49
24	14	38	03.903			-16	48	50.69		24	16	38	44.612		-25	49	45.63	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
October 8							October 10						
^h	^h	^m	^s	[°]	[']	["]	^h	^h	^m	^s	[°]	[']	["]
0	16	38	44.612	156.141	-25	49 45.63	0	18	43	42.686	152.909	-28	05 56.37
1	16	41	20.753	156.271	25	56 59.18	1	18	46	15.595	152.638	28	04 16.28
2	16	43	57.024	156.393	26	04 01.75	2	18	48	48.233	152.358	28	02 25.75
3	16	46	33.417	156.507	26	10 53.31	3	18	51	20.591	152.072	28	00 24.84
4	16	49	09.924	156.615	26	17 33.81	4	18	53	52.663	151.779	27	58 13.60
5	16	51	46.539	156.713	26	24 03.22	5	18	56	24.442	151.480	27	55 52.11
6	16	54	23.252	156.806	26	30 21.50	6	18	58	55.922	151.173	27	53 20.41
7	16	57	00.058	156.889	26	36 28.63	7	19	01	27.095	150.861	27	50 38.58
8	16	59	36.947	156.966	26	42 24.57	8	19	03	57.956	150.542	27	47 46.68
9	17	02	13.913	157.032	26	48 09.30	9	19	06	28.498	150.217	27	44 44.77
10	17	04	50.945	157.093	26	53 42.80	10	19	08	58.715	149.887	27	41 32.93
11	17	07	28.038	157.143	26	59 05.04	11	19	11	28.602	149.550	27	38 11.21
12	17	10	05.181	157.186	27	04 16.00	12	19	13	58.152	149.207	27	34 39.70
13	17	12	42.367	157.220	27	09 15.67	13	19	16	27.359	148.861	27	30 58.45
14	17	15	19.587	157.246	27	14 04.02	14	19	18	56.220	148.507	27	27 07.55
15	17	17	56.833	157.264	27	18 41.05	15	19	21	24.727	148.150	27	23 07.06
16	17	20	34.097	157.271	27	23 06.75	16	19	23	52.877	147.787	27	18 57.06
17	17	23	11.368	157.271	27	27 21.11	17	19	26	20.664	147.419	27	14 37.62
18	17	25	48.639	157.262	27	31 24.12	18	19	28	48.083	147.048	27	10 08.81
19	17	28	25.901	157.244	27	35 15.78	19	19	31	15.131	146.671	27	05 30.72
20	17	31	03.145	157.217	27	38 56.08	20	19	33	41.802	146.291	27	00 43.42
21	17	33	40.362	157.181	27	42 25.03	21	19	36	08.093	145.906	26	55 46.98
22	17	36	17.543	157.137	27	45 42.63	22	19	38	33.999	145.517	26	50 41.49
23	17	38	54.680	157.083	-27	48 48.88	23	19	40	59.516	145.126	-26	45 27.02
October 9							October 11						
0	17	41	31.763	157.020	-27	51 43.80	0	19	43	24.642	144.730	-26	40 03.65
1	17	44	08.783	156.949	27	54 27.39	1	19	45	49.372	144.330	26	34 31.46
2	17	46	45.732	156.868	27	56 59.66	2	19	48	13.702	143.929	26	28 50.54
3	17	49	22.600	156.778	27	59 20.63	3	19	50	37.631	143.523	26	23 00.96
4	17	51	59.378	156.680	28	01 30.31	4	19	53	01.154	143.116	26	17 02.80
5	17	54	36.058	156.573	28	03 28.72	5	19	55	24.270	142.705	26	10 56.15
6	17	57	12.631	156.456	28	05 15.88	6	19	57	46.975	142.292	26	04 41.09
7	17	59	49.087	156.331	28	06 51.82	7	20	00	09.267	141.876	25	58 17.69
8	18	02	25.418	156.197	28	08 16.55	8	20	02	31.143	141.459	25	51 46.05
9	18	05	01.615	156.054	28	09 30.11	9	20	04	52.602	141.040	25	45 06.25
10	18	07	37.669	155.903	28	10 32.53	10	20	07	13.642	140.618	25	38 18.36
11	18	10	13.572	155.743	28	11 23.82	11	20	09	34.260	140.196	25	31 22.48
12	18	12	49.315	155.574	28	12 04.03	12	20	11	54.456	139.771	25	24 18.68
13	18	15	24.889	155.396	28	12 33.19	13	20	14	14.227	139.345	25	17 07.05
14	18	18	00.285	155.211	28	12 51.34	14	20	16	33.572	138.919	25	09 47.68
15	18	20	35.496	155.017	28	12 58.51	15	20	18	52.491	138.491	25	02 20.64
16	18	23	10.513	154.814	28	12 54.75	16	20	21	10.982	138.062	24	54 46.02
17	18	25	45.327	154.603	28	12 40.09	17	20	23	29.044	137.632	24	47 03.91
18	18	28	19.930	154.386	28	12 14.59	18	20	25	46.676	137.203	24	39 14.39
19	18	30	54.316	154.158	28	11 38.27	19	20	28	03.879	136.772	24	31 17.54
20	18	33	28.474	153.924	28	10 51.21	20	20	30	20.651	136.342	24	23 13.45
21	18	36	02.398	153.682	28	09 53.43	21	20	32	36.993	135.911	24	15 02.20
22	18	38	36.080	153.431	28	08 45.00	22	20	34	52.904	135.481	24	06 43.87
23	18	41	09.511	153.175	28	07 25.96	23	20	37	08.385	135.050	23	58 18.55
24	18	43	42.686		-28	05 56.37	24	20	39	23.435		-23	49 46.33

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
October 12			October 14		
h	h m s	° ' "	h	h m s	° ' "
0	20 39 23.435	134.620	0	22 19 30.636	116.339
1	20 41 38.055	134.190	1	22 21 26.975	116.037
2	20 43 52.245	133.761	2	22 23 23.012	115.738
3	20 46 06.006	133.332	3	22 25 18.750	115.444
4	20 48 19.338	132.905	4	22 27 14.194	115.154
5	20 50 32.243	132.478	5	22 29 09.348	114.867
6	20 52 44.721	132.052	6	22 31 04.215	114.585
7	20 54 56.773	131.628	7	22 32 58.800	114.308
8	20 57 08.401	131.205	8	22 34 53.108	114.033
9	20 59 19.606	130.783	9	22 36 47.141	113.762
10	21 01 30.389	130.362	10	22 38 40.903	113.498
11	21 03 40.751	129.944	11	22 40 34.401	113.235
12	21 05 50.695	129.528	12	22 42 27.636	112.978
13	21 08 00.223	129.112	13	22 44 20.614	112.724
14	21 10 09.335	128.699	14	22 46 13.338	112.475
15	21 12 18.034	128.287	15	22 48 05.813	112.230
16	21 14 26.321	127.879	16	22 49 58.043	111.989
17	21 16 34.200	127.472	17	22 51 50.032	111.752
18	21 18 41.672	127.068	18	22 53 41.784	111.519
19	21 20 48.740	126.665	19	22 55 33.303	111.292
20	21 22 55.405	126.266	20	22 57 24.595	111.067
21	21 25 01.671	125.868	21	22 59 15.662	110.847
22	21 27 07.539	125.474	22	23 01 06.509	110.631
23	21 29 13.013	125.082	23	23 02 57.140	110.420
October 13			October 15		
0	21 31 18.095	124.693	0	23 04 47.560	110.213
1	21 33 22.788	124.307	1	23 06 37.773	110.010
2	21 35 27.095	123.924	2	23 08 27.783	109.811
3	21 37 31.019	123.543	3	23 10 17.594	109.616
4	21 39 34.562	123.166	4	23 12 07.210	109.427
5	21 41 37.728	122.792	5	23 13 56.637	109.240
6	21 43 40.520	122.421	6	23 15 45.877	109.058
7	21 45 42.941	122.053	7	23 17 34.935	108.881
8	21 47 44.994	121.688	8	23 19 23.816	108.707
9	21 49 46.682	121.327	9	23 21 12.523	108.538
10	21 51 48.009	120.970	10	23 23 01.061	108.374
11	21 53 48.979	120.614	11	23 24 49.435	108.212
12	21 55 49.593	120.265	12	23 26 37.647	108.056
13	21 57 49.858	119.916	13	23 28 25.703	107.904
14	21 59 49.774	119.573	14	23 30 13.607	107.756
15	22 01 49.347	119.232	15	23 32 01.363	107.612
16	22 03 48.579	118.896	16	23 33 48.975	107.473
17	22 05 47.475	118.563	17	23 35 36.448	107.337
18	22 07 46.038	118.234	18	23 37 23.785	107.207
19	22 09 44.272	117.909	19	23 39 10.992	107.079
20	22 11 42.181	117.586	20	23 40 58.071	106.956
21	22 13 39.767	117.269	21	23 42 45.027	106.838
22	22 15 37.036	116.955	22	23 44 31.865	106.724
23	22 17 33.991	116.645	23	23 46 18.589	106.613
24	22 19 30.636		24	23 48 05.202	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
October 16			October 18		
h	h m s	° ' "	h	h m s	° ' "
0	23 48 05.202	106.508	0	1 12 33.155	106.173
1	23 49 51.710	106.405	1	1 14 19.328	106.261
2	23 51 38.115	106.308	2	1 16 05.589	106.353
3	23 53 24.423	106.215	3	1 17 51.942	106.448
4	23 55 10.638	106.125	4	1 19 38.390	106.548
5	23 56 56.763	106.040	5	1 21 24.938	106.650
6	23 58 42.803	105.959	6	1 23 11.588	106.757
7	0 00 28.762	105.881	7	1 24 58.345	106.866
8	0 02 14.643	105.809	8	1 26 45.211	106.980
9	0 04 00.452	105.741	9	1 28 32.191	107.098
10	0 05 46.193	105.675	10	1 30 19.289	107.218
11	0 07 31.868	105.615	11	1 32 06.507	107.343
12	0 09 17.483	105.559	12	1 33 53.850	107.470
13	0 11 03.042	105.507	13	1 35 41.320	107.601
14	0 12 48.549	105.458	14	1 37 28.921	107.737
15	0 14 34.007	105.413	15	1 39 16.658	107.875
16	0 16 19.420	105.374	16	1 41 04.533	108.016
17	0 18 04.794	105.338	17	1 42 52.549	108.162
18	0 19 50.132	105.305	18	1 44 40.711	108.310
19	0 21 35.437	105.278	19	1 46 29.021	108.463
20	0 23 20.715	105.253	20	1 48 17.484	108.618
21	0 25 05.968	105.234	21	1 50 06.102	108.776
22	0 26 51.202	105.217	22	1 51 54.878	108.939
23	0 28 36.419	105.205	23	1 53 43.817	109.104
October 17			October 19		
0	0 30 21.624	105.198	0	1 55 32.921	109.273
1	0 32 06.822	105.193	1	1 57 22.194	109.444
2	0 33 52.015	105.193	2	1 59 11.638	109.620
3	0 35 37.208	105.197	3	2 01 01.258	109.799
4	0 37 22.405	105.205	4	2 02 51.057	109.980
5	0 39 07.610	105.216	5	2 04 41.037	110.165
6	0 40 52.826	105.232	6	2 06 31.202	110.352
7	0 42 38.058	105.252	7	2 08 21.554	110.544
8	0 44 23.310	105.276	8	2 10 12.098	110.738
9	0 46 08.586	105.302	9	2 12 02.836	110.935
10	0 47 53.888	105.334	10	2 13 53.771	111.135
11	0 49 39.222	105.369	11	2 15 44.906	111.338
12	0 51 24.591	105.408	12	2 17 36.244	111.545
13	0 53 09.999	105.451	13	2 19 27.789	111.754
14	0 54 55.450	105.498	14	2 21 19.543	111.965
15	0 56 40.948	105.548	15	2 23 11.508	112.181
16	0 58 26.496	105.603	16	2 25 03.689	112.398
17	1 00 12.099	105.660	17	2 26 56.087	112.619
18	1 01 57.759	105.723	18	2 28 48.706	112.842
19	1 03 43.482	105.788	19	2 30 41.548	113.068
20	1 05 29.270	105.858	20	2 32 34.616	113.296
21	1 07 15.128	105.931	21	2 34 27.912	113.528
22	1 09 01.059	106.008	22	2 36 21.440	113.762
23	1 10 47.067	106.088	23	2 38 15.202	113.998
24	1 12 33.155	106.173	24	2 40 09.200	114.235

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
October 20			October 22		
h	h m s	° ' "	h	h m s	° ' "
0	2 40 09.200	+17 01 58.25	0	4 16 36.722	+24 41 24.16
1	2 42 03.437	+17 13 26.14	1	4 18 44.323	+24 48 38.38
2	2 43 57.916	+17 24 50.02	2	4 20 52.214	+24 55 45.97
3	2 45 52.639	+17 36 09.86	3	4 23 00.393	+25 02 46.86
4	2 47 47.608	+17 47 25.59	4	4 25 08.860	+25 09 41.01
5	2 49 42.826	+17 58 37.16	5	4 27 17.613	+25 16 28.36
6	2 51 38.295	+18 09 44.52	6	4 29 26.651	+25 23 08.86
7	2 53 34.017	+18 20 47.61	7	4 31 35.973	+25 29 42.46
8	2 55 29.994	+18 31 46.38	8	4 33 45.577	+25 36 09.10
9	2 57 26.229	+18 42 40.77	9	4 35 55.463	+25 42 28.73
10	2 59 22.724	+18 53 30.74	10	4 38 05.627	+25 48 41.31
11	3 01 19.481	+19 04 16.23	11	4 40 16.070	+25 54 46.77
12	3 03 16.501	+19 14 57.18	12	4 42 26.788	+26 00 45.06
13	3 05 13.787	+19 25 33.53	13	4 44 37.780	+26 06 36.14
14	3 07 11.341	+19 36 05.24	14	4 46 49.044	+26 12 19.96
15	3 09 09.164	+19 46 32.26	15	4 49 00.578	+26 17 56.46
16	3 11 07.259	+19 56 54.51	16	4 51 12.380	+26 23 25.59
17	3 13 05.626	+20 07 11.96	17	4 53 24.447	+26 28 47.31
18	3 15 04.268	+20 17 24.53	18	4 55 36.778	+26 34 01.57
19	3 17 03.187	+20 27 32.19	19	4 57 49.369	+26 39 08.31
20	3 19 02.383	+20 37 34.87	20	5 00 02.218	+26 44 07.49
21	3 21 01.858	+20 47 32.53	21	5 02 15.322	+26 48 59.06
22	3 23 01.614	+20 57 25.09	22	5 04 28.679	+26 53 42.98
23	3 25 01.653	+21 07 12.51	23	5 06 42.285	+26 58 19.19
October 21			October 23		
0	3 27 01.974	+21 16 54.74	0	5 08 56.139	+27 02 47.65
1	3 29 02.580	+21 26 31.71	1	5 11 10.236	+27 07 08.32
2	3 31 03.472	+21 36 03.37	2	5 13 24.574	+27 11 21.15
3	3 33 04.650	+21 45 29.67	3	5 15 39.150	+27 15 26.09
4	3 35 06.116	+21 54 50.55	4	5 17 53.959	+27 19 23.11
5	3 37 07.871	+22 04 05.95	5	5 20 09.000	+27 23 12.15
6	3 39 09.916	+22 13 15.82	6	5 22 24.267	+27 26 53.18
7	3 41 12.250	+22 22 20.10	7	5 24 39.759	+27 30 26.15
8	3 43 14.876	+22 31 18.74	8	5 26 55.470	+27 33 51.03
9	3 45 17.793	+22 40 11.69	9	5 29 11.398	+27 37 07.76
10	3 47 21.002	+22 48 58.87	10	5 31 27.539	+27 40 16.32
11	3 49 24.504	+22 57 40.25	11	5 33 43.888	+27 43 16.65
12	3 51 28.299	+23 06 15.76	12	5 36 00.441	+27 46 08.73
13	3 53 32.388	+23 14 45.35	13	5 38 17.196	+27 48 52.51
14	3 55 36.770	+23 23 08.96	14	5 40 34.147	+27 51 27.96
15	3 57 41.445	+23 31 26.54	15	5 42 51.290	+27 53 55.04
16	3 59 46.415	+23 39 38.03	16	5 45 08.621	+27 56 13.72
17	4 01 51.678	+23 47 43.38	17	5 47 26.136	+27 58 23.96
18	4 03 57.234	+23 55 42.53	18	5 49 43.830	+28 00 25.72
19	4 06 03.084	+24 03 35.42	19	5 52 01.700	+28 02 18.97
20	4 08 09.228	+24 11 22.01	20	5 54 19.739	+28 04 03.68
21	4 10 15.663	+24 19 02.23	21	5 56 37.944	+28 05 39.82
22	4 12 22.392	+24 26 36.03	22	5 58 56.310	+28 07 07.36

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
October 24			October 26		
h	h m s	s	h	h m s	s
0	6 03 33.507	138.821	0	7 55 49.207	139.967
1	6 05 52.328	138.963	1	7 58 09.174	139.878
2	6 08 11.291	139.099	2	8 00 29.052	139.786
3	6 10 30.390	139.232	3	8 02 48.838	139.691
4	6 12 49.622	139.359	4	8 05 08.529	139.592
5	6 15 08.981	139.482	5	8 07 28.121	139.491
6	6 17 28.463	139.598	6	8 09 47.612	139.385
7	6 19 48.061	139.710	7	8 12 06.997	139.277
8	6 22 07.771	139.817	8	8 14 26.274	139.166
9	6 24 27.588	139.919	9	8 16 45.440	139.052
10	6 26 47.507	140.015	10	8 19 04.492	138.935
11	6 29 07.522	140.106	11	8 21 23.427	138.815
12	6 31 27.628	140.193	12	8 23 42.242	138.694
13	6 33 47.821	140.274	13	8 26 00.936	138.569
14	6 36 08.095	140.349	14	8 28 19.505	138.442
15	6 38 28.444	140.420	15	8 30 37.947	138.313
16	6 40 48.864	140.485	16	8 32 56.260	138.182
17	6 43 09.349	140.546	17	8 35 14.442	138.048
18	6 45 29.895	140.600	18	8 37 32.490	137.914
19	6 47 50.495	140.650	19	8 39 50.404	137.777
20	6 50 11.145	140.695	20	8 42 08.181	137.637
21	6 52 31.840	140.733	21	8 44 25.818	137.498
22	6 54 52.573	140.768	22	8 46 43.316	137.356
23	6 57 13.341	140.797	23	8 49 00.672	137.213
October 25			October 27		
0	6 59 34.138	140.821	0	8 51 17.885	137.068
1	7 01 54.959	140.839	1	8 53 34.953	136.923
2	7 04 15.798	140.853	2	8 55 51.876	136.776
3	7 06 36.651	140.862	3	8 58 08.652	136.629
4	7 08 57.513	140.865	4	9 00 25.281	136.481
5	7 11 18.378	140.864	5	9 02 41.762	136.331
6	7 13 39.242	140.858	6	9 04 58.093	136.182
7	7 16 00.100	140.847	7	9 07 14.275	136.031
8	7 18 20.947	140.830	8	9 09 30.306	135.882
9	7 20 41.777	140.810	9	9 11 46.188	135.730
10	7 23 02.587	140.784	10	9 14 01.918	135.579
11	7 25 23.371	140.755	11	9 16 17.497	135.429
12	7 27 44.126	140.719	12	9 18 32.926	135.277
13	7 30 04.845	140.680	13	9 20 48.203	135.127
14	7 32 25.525	140.636	14	9 23 03.330	134.976
15	7 34 46.161	140.588	15	9 25 18.306	134.826
16	7 37 06.749	140.535	16	9 27 33.132	134.676
17	7 39 27.284	140.478	17	9 29 47.808	134.527
18	7 41 47.762	140.418	18	9 32 02.335	134.378
19	7 44 08.180	140.352	19	9 34 16.713	134.231
20	7 46 28.532	140.282	20	9 36 30.944	134.084
21	7 48 48.814	140.210	21	9 38 45.028	133.938
22	7 51 09.024	140.132	22	9 40 58.966	133.794
23	7 53 29.156	140.051	23	9 43 12.760	133.649
24	7 55 49.207	140.051	24	9 45 26.409	133.500

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
October 28							October 30						
h	h	m	s				h	h	m	s			
0	9 45	26.409	^s 133.508	+18 37 22.02	^s -755.42		0	11 30 17.449	^s 129.796	+ 6 42 55.07	^s -1007.33		
1	9 47	39.917	133.366	18 24 46.60	762.30		1	11 32 27.245	129.811	6 26 07.74	1010.61		
2	9 49	53.283	133.227	18 12 04.30	769.11		2	11 34 37.056	129.830	6 09 17.13	1013.80		
3	9 52	06.510	133.089	17 59 15.19	775.87		3	11 36 46.886	129.856	5 52 23.33	1016.88		
4	9 54	19.599	132.953	17 46 19.32	782.57		4	11 38 56.742	129.884	5 35 26.45	1019.87		
5	9 56	32.552	132.818	17 33 16.75	789.21		5	11 41 06.626	129.919	5 18 26.58	1022.78		
6	9 58	45.370	132.685	17 20 07.54	795.78		6	11 43 16.545	129.957	5 01 23.80	1025.57		
7	10 00	58.055	132.555	17 06 51.76	802.30		7	11 45 26.502	130.001	4 44 18.23	1028.28		
8	10 03	10.610	132.426	16 53 29.46	808.74		8	11 47 36.503	130.049	4 27 09.95	1030.89		
9	10 05	23.036	132.299	16 40 00.72	815.13		9	11 49 46.552	130.102	4 09 59.06	1033.39		
10	10 07	35.335	132.175	16 26 25.59	821.45		10	11 51 56.654	130.160	3 52 45.67	1035.80		
11	10 09	47.510	132.053	16 12 44.14	827.71		11	11 54 06.814	130.224	3 35 29.87	1038.11		
12	10 11	59.563	131.932	15 58 56.43	833.90		12	11 56 17.038	130.291	3 18 11.76	1040.32		
13	10 14	11.495	131.816	15 45 02.53	840.03		13	11 58 27.329	130.364	3 00 51.44	1042.42		
14	10 16	23.311	131.700	15 31 02.50	846.08		14	12 00 37.693	130.442	2 43 29.02	1044.43		
15	10 18	35.011	131.588	15 16 56.42	852.08		15	12 02 48.135	130.525	2 26 04.59	1046.32		
16	10 20	46.599	131.479	15 02 44.34	858.00		16	12 04 58.660	130.613	2 08 38.27	1048.12		
17	10 22	58.078	131.372	14 48 26.34	863.85		17	12 07 09.273	130.706	1 51 10.15	1049.81		
18	10 25	09.450	131.268	14 34 02.49	869.63		18	12 09 19.979	130.803	1 33 40.34	1051.38		
19	10 27	20.718	131.166	14 19 32.86	875.35		19	12 11 30.782	130.907	1 16 08.96	1052.87		
20	10 29	31.884	131.069	14 04 57.51	880.99		20	12 13 41.689	131.015	0 58 36.09	1054.23		
21	10 31	42.953	130.973	13 50 16.52	886.56		21	12 15 52.704	131.128	0 41 01.86	1055.49		
22	10 33	53.926	130.882	13 35 29.96	892.06		22	12 18 03.832	131.246	0 23 26.37	1056.64		
23	10 36	04.808	130.793	+13 20 37.90	-897.49		23	12 20 15.078	131.369	+ 0 05 49.73	-1057.67		
October 29							October 31						
0	10 38	15.601	130.707	+13 05 40.41	-902.84		0	12 22 26.447	131.498	- 0 11 47.94	-1058.61		
1	10 40	26.308	130.625	12 50 37.57	908.12		1	12 24 37.945	131.632	0 29 26.55	1059.42		
2	10 42	36.933	130.547	12 35 29.45	913.32		2	12 26 49.577	131.770	0 47 05.97	1060.12		
3	10 44	47.480	130.471	12 20 16.13	918.44		3	12 29 01.347	131.914	1 04 46.09	1060.72		
4	10 46	57.951	130.400	12 04 57.69	923.50		4	12 31 13.261	132.063	1 22 26.81	1061.19		
5	10 49	08.351	130.331	11 49 34.19	928.47		5	12 33 25.324	132.217	1 40 08.00	1061.54		
6	10 51	18.682	130.267	11 34 05.72	933.37		6	12 35 37.541	132.376	1 57 49.54	1061.79		
7	10 53	28.949	130.206	11 18 32.35	938.19		7	12 37 49.917	132.541	2 15 31.33	1061.92		
8	10 55	39.155	130.150	11 02 54.16	942.92		8	12 40 02.458	132.709	2 33 13.25	1061.93		
9	10 57	49.305	130.096	10 47 11.24	947.58		9	12 42 15.167	132.884	2 50 55.18	1061.82		
10	10 59	59.401	130.047	10 31 23.66	952.15		10	12 44 28.051	133.064	3 08 37.00	1061.58		
11	11 02	09.448	130.002	10 15 31.51	956.65		11	12 46 41.115	133.248	3 26 18.58	1061.24		
12	11 04	19.450	129.960	9 59 34.86	961.07		12	12 48 54.363	133.437	3 43 59.82	1060.77		
13	11 06	29.410	129.924	9 43 33.79	965.39		13	12 51 07.800	133.633	4 01 40.59	1060.18		
14	11 08	39.334	129.890	9 27 28.40	969.65		14	12 53 21.433	133.831	4 19 20.77	1059.47		
15	11 10	49.224	129.861	9 11 18.75	973.80		15	12 55 35.264	134.036	4 37 00.24	1058.63		
16	11 12	59.085	129.837	8 55 04.95	977.88		16	12 57 49.300	134.246	4 54 38.87	1057.67		
17	11 15	08.922	129.816	8 38 47.07	981.87		17	13 00 03.546	134.460	5 12 16.54	1056.58		
18	11 17	18.738	129.800	8 22 25.20	985.78		18	13 02 18.006	134.679	5 29 53.12	1055.38		
19	11 19	28.538	129.788	8 05 59.42	989.59		19	13 04 32.685	134.904	5 47 28.50	1054.04		
20	11 21	38.326	129.780	7 49 29.83	993.32		20	13 06 47.589	135.132	6 05 02.54	1052.58		
21	11 23	48.106	129.778	7 32 56.51	996.96		21	13 09 02.721	135.367	6 22 35.12	1050.99		
22	11 25	57.884	129.779	7 16 19.55	1000.51		22	13 11 18.088	135.604	6 40 06.11	1049.27		
23	11 28	07.663	129.786	6 59 39.04	-1003.97		23	13 13 33.692	135.848	6 57 35.38	-1047.43		
24	11 30	17.449		+ 6 42 55.07			24	13 15 49.540		- 7 15 02.81			

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
November 1							November 3						
^h	^h	^m	^s		[°]	[']	^h	^h	^m	^s		[°]	[']
0	13	15	49.540	136.096	-7	15 02.81	0	15	10	29.989	151.805	-19	53 11.27
1	13	18	05.636	136.348	7	32 28.27	1	15	13	01.794	152.160	20	06 24.09
2	13	20	21.984	136.605	7	49 51.62	2	15	15	33.954	152.511	20	19 28.41
3	13	22	38.589	136.867	8	07 12.73	3	15	18	06.465	152.861	20	32 24.09
4	13	24	55.456	137.132	8	24 31.49	4	15	20	39.326	153.208	20	45 11.01
5	13	27	12.588	137.403	8	41 47.74	5	15	23	12.534	153.554	20	57 49.06
6	13	29	29.991	137.678	8	59 01.37	6	15	25	46.088	153.895	21	10 18.11
7	13	31	47.669	137.957	9	16 12.24	7	15	28	19.983	154.235	21	22 38.05
8	13	34	05.626	138.240	9	33 20.21	8	15	30	54.218	154.572	21	34 48.77
9	13	36	23.866	138.527	9	50 25.16	9	15	33	28.790	154.903	21	46 50.14
10	13	38	42.393	138.819	10	07 26.95	10	15	36	03.693	155.233	21	58 42.05
11	13	41	01.212	139.114	10	24 25.44	11	15	38	38.926	155.559	22	10 24.40
12	13	43	20.326	139.413	10	41 20.50	12	15	41	14.485	155.879	22	21 57.08
13	13	45	39.739	139.716	10	58 12.00	13	15	43	50.364	156.196	22	33 19.97
14	13	47	59.455	140.023	11	14 59.80	14	15	46	26.560	156.509	22	44 32.97
15	13	50	19.478	140.334	11	31 43.77	15	15	49	03.069	156.815	22	55 35.98
16	13	52	39.812	140.647	11	48 23.77	16	15	51	39.884	157.118	23	06 28.89
17	13	55	00.459	140.965	12	04 59.66	17	15	54	17.002	157.416	23	17 11.61
18	13	57	21.424	141.285	12	21 31.30	18	15	56	54.418	157.706	23	27 44.03
19	13	59	42.709	141.609	12	37 58.57	19	15	59	32.124	157.993	23	38 06.06
20	14	02	04.318	141.937	12	54 21.32	20	16	02	10.117	158.273	23	48 17.60
21	14	04	26.255	142.266	13	10 39.42	21	16	04	48.390	158.546	23	58 18.57
22	14	06	48.521	142.600	13	26 52.73	22	16	07	26.936	158.814	24	08 08.86
23	14	09	11.121	142.935	-13	43 01.11	23	16	10	05.750	159.074	-24	17 48.40
November 2							November 4						
0	14	11	34.056	143.274	-13	59 04.42	0	16	12	44.824	159.328	-24	27 17.10
1	14	13	57.330	143.615	14	15 02.54	1	16	15	24.152	159.575	24	36 34.87
2	14	16	20.945	143.958	14	30 55.31	2	16	18	03.727	159.815	24	45 41.63
3	14	18	44.903	144.303	14	46 42.61	3	16	20	43.542	160.046	24	54 37.31
4	14	21	09.206	144.652	15	02 24.30	4	16	23	23.588	160.271	25	03 21.83
5	14	23	33.858	145.001	15	18 00.24	5	16	26	03.859	160.486	25	11 55.11
6	14	25	58.859	145.352	15	33 30.29	6	16	28	44.345	160.695	25	20 17.09
7	14	28	24.211	145.706	15	48 54.32	7	16	31	25.040	160.895	25	28 27.69
8	14	30	49.917	146.061	16	04 12.19	8	16	34	05.935	161.086	25	36 26.85
9	14	33	15.978	146.417	16	19 23.77	9	16	36	47.021	161.269	25	44 14.51
10	14	35	42.395	146.774	16	34 28.92	10	16	39	28.290	161.442	25	51 50.60
11	14	38	09.169	147.133	16	49 27.51	11	16	42	09.732	161.607	25	59 15.07
12	14	40	36.302	147.492	17	04 19.39	12	16	44	51.339	161.763	26	06 27.86
13	14	43	03.794	147.851	17	19 04.44	13	16	47	33.102	161.908	26	13 28.92
14	14	45	31.645	148.213	17	33 42.53	14	16	50	15.010	162.045	26	20 18.20
15	14	47	59.858	148.573	17	48 13.51	15	16	52	57.055	162.172	26	26 55.65
16	14	50	28.431	148.934	18	02 37.27	16	16	55	39.227	162.288	26	33 21.23
17	14	52	57.365	149.296	18	16 53.65	17	16	58	21.515	162.395	26	39 34.90
18	14	55	26.661	149.656	18	31 02.55	18	17	01	03.910	162.491	26	45 36.62
19	14	57	56.317	150.017	18	45 03.82	19	17	03	46.401	162.578	26	51 26.35
20	15	00	26.334	150.376	18	58 57.33	20	17	06	28.979	162.654	26	57 04.07
21	15	02	56.710	150.735	19	12 42.96	21	17	09	11.633	162.719	27	02 29.74
22	15	05	27.445	151.094	19	26 20.57	22	17	11	54.352	162.774	27	07 43.33
23	15	07	58.539	151.450	19	39 50.05	23	17	14	37.126	162.818	27	12 44.83
24	15	10	29.989		-19	53 11.27	24	17	17	19.944		-27	17 34.21

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
November 5							November 7						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	17	17	19.944	162.851	-27	17 34.21	0	19	24	55.896	152.196	-27	16 37.39
1	17	20	02.795	162.874	27	22 11.45	1	19	27	28.092	151.767	27	12 05.00
2	17	22	45.669	162.885	27	26 36.55	2	19	29	59.859	151.334	27	07 22.76
3	17	25	28.554	162.886	27	30 49.48	3	19	32	31.193	150.894	27	02 30.76
4	17	28	11.440	162.875	27	34 50.24	4	19	35	02.087	150.451	26	57 29.10
5	17	30	54.315	162.853	27	38 38.82	5	19	37	32.538	150.002	26	52 17.87
6	17	33	37.168	162.821	27	42 15.23	6	19	40	02.540	149.549	26	46 57.17
7	17	36	19.989	162.777	27	45 39.46	7	19	42	32.089	149.093	26	41 27.08
8	17	39	02.766	162.721	27	48 51.51	8	19	45	01.182	148.631	26	35 47.71
9	17	41	45.487	162.655	27	51 51.39	9	19	47	29.813	148.167	26	29 59.15
10	17	44	28.142	162.577	27	54 39.11	10	19	49	57.980	147.699	26	24 01.49
11	17	47	10.719	162.489	27	57 14.69	11	19	52	25.679	147.227	26	17 54.84
12	17	49	53.208	162.389	27	59 38.12	12	19	54	52.906	146.753	26	11 39.29
13	17	52	35.597	162.278	28	01 49.45	13	19	57	19.659	146.276	26	05 14.94
14	17	55	17.875	162.156	28	03 48.67	14	19	59	45.935	145.796	25	58 41.89
15	17	58	00.031	162.023	28	05 35.83	15	20	02	11.731	145.314	25	52 00.24
16	18	00	42.054	161.879	28	07 10.93	16	20	04	37.045	144.830	25	45 10.08
17	18	03	23.933	161.723	28	08 34.02	17	20	07	01.875	144.343	25	38 11.52
18	18	06	05.656	161.558	28	09 45.12	18	20	09	26.218	143.855	25	31 04.65
19	18	08	47.214	161.382	28	10 44.27	19	20	11	50.073	143.365	25	23 49.57
20	18	11	28.596	161.194	28	11 31.50	20	20	14	13.438	142.874	25	16 26.38
21	18	14	09.790	160.996	28	12 06.85	21	20	16	36.312	142.382	25	08 55.18
22	18	16	50.786	160.788	28	12 30.37	22	20	18	58.694	141.889	25	01 16.07
23	18	19	31.574	160.569	-28	12 42.10	23	20	21	20.583	141.394	-24	53 29.15
						+							+474.63
						0.02							
November 6							November 8						
0	18	22	12.143	160.341	-28	12 42.08	0	20	23	41.977	140.901	-24	45 34.52
1	18	24	52.484	160.101	28	12 30.37	1	20	26	02.878	140.405	24	37 32.27
2	18	27	32.585	159.852	28	12 07.01	2	20	28	23.283	139.910	24	29 22.51
3	18	30	12.437	159.593	28	11 32.06	3	20	30	43.193	139.415	24	21 05.33
4	18	32	52.030	159.325	28	10 45.58	4	20	33	02.608	138.919	24	12 40.83
5	18	35	31.355	159.047	28	09 47.62	5	20	35	21.527	138.425	24	04 09.11
6	18	38	10.402	158.759	28	08 38.24	6	20	37	39.952	137.930	23	55 30.27
7	18	40	49.161	158.463	28	07 17.51	7	20	39	57.882	137.437	23	46 44.40
8	18	43	27.624	158.157	28	05 45.49	8	20	42	15.319	136.944	23	37 51.59
9	18	46	05.781	157.843	28	04 02.25	9	20	44	32.263	136.451	23	28 51.96
10	18	48	43.624	157.519	28	02 07.85	10	20	46	48.714	135.961	23	19 45.59
11	18	51	21.143	157.188	28	00 02.37	11	20	49	04.675	135.471	23	10 32.57
12	18	53	58.331	156.847	27	57 45.87	12	20	51	20.146	134.983	23	01 13.01
13	18	56	35.178	156.500	27	55 18.44	13	20	53	35.129	134.497	22	51 46.99
14	18	59	11.678	156.143	27	52 40.15	14	20	55	49.626	134.011	22	42 14.61
15	19	01	47.821	155.780	27	49 51.06	15	20	58	03.637	133.528	22	32 35.97
16	19	04	23.601	155.409	27	46 51.27	16	21	00	17.165	133.046	22	22 51.16
17	19	06	59.010	155.030	27	43 40.86	17	21	02	30.211	132.568	22	13 00.26
18	19	09	34.040	154.645	27	40 19.89	18	21	04	42.779	132.090	22	03 03.37
19	19	12	08.685	154.252	27	36 48.47	19	21	06	54.869	131.616	21	53 00.59
20	19	14	42.937	153.854	27	33 06.66	20	21	09	06.485	131.143	21	42 52.00
21	19	17	16.791	153.448	27	29 14.57	21	21	11	17.628	130.674	21	32 37.69
22	19	19	50.239	153.037	27	25 12.26	22	21	13	28.302	130.206	21	22 17.75
23	19	22	23.276	152.620	27	20 59.84	23	21	15	38.508	129.742	21	11 52.28
24	19	24	55.896		-27	16 37.39	24	21	17	48.250		-21	01 21.35
						+							+630.93
						262.45							

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
November 13			November 15		
h	h m s	° ' "	h	h m s	° ' "
0	0 19 44.329 ^s 104.955	- 0 08 53.95 ^s +844.21	0	1 44 21.046 ^s 108.191	+10 48 54.72 ^s +782.22
1	0 21 29.284 ^s 104.924	+ 0 05 10.26 ^s 843.94	1	1 46 09.237 ^s 108.352	11 01 56.94 ^s 779.82
2	0 23 14.208 ^s 104.899	0 19 14.20 ^s 843.61	2	1 47 57.589 ^s 108.519	11 14 56.76 ^s 777.38
3	0 24 59.107 ^s 104.877	0 33 17.81 ^s 843.24	3	1 49 46.108 ^s 108.689	11 27 54.14 ^s 774.89
4	0 26 43.984 ^s 104.861	0 47 21.05 ^s 842.85	4	1 51 34.797 ^s 108.862	11 40 49.03 ^s 772.35
5	0 28 28.845 ^s 104.847	1 01 23.90 ^s 842.39	5	1 53 23.659 ^s 109.039	11 53 41.38 ^s 769.76
6	0 30 13.692 ^s 104.839	1 15 26.29 ^s 841.90	6	1 55 12.698 ^s 109.218	12 06 31.14 ^s 767.12
7	0 31 58.531 ^s 104.835	1 29 28.19 ^s 841.37	7	1 57 01.916 ^s 109.402	12 19 18.26 ^s 764.44
8	0 33 43.366 ^s 104.835	1 43 29.56 ^s 840.79	8	1 58 51.318 ^s 109.589	12 32 02.70 ^s 761.70
9	0 35 28.201 ^s 104.840	1 57 30.35 ^s 840.17	9	2 00 40.907 ^s 109.779	12 44 44.40 ^s 758.91
10	0 37 13.041 ^s 104.848	2 11 30.52 ^s 839.52	10	2 02 30.686 ^s 109.973	12 57 23.31 ^s 756.08
11	0 38 57.889 ^s 104.862	2 25 30.04 ^s 838.81	11	2 04 20.659 ^s 110.169	13 09 59.39 ^s 753.19
12	0 40 42.751 ^s 104.878	2 39 28.85 ^s 838.07	12	2 06 10.828 ^s 110.370	13 22 32.58 ^s 750.25
13	0 42 27.629 ^s 104.900	2 53 26.92 ^s 837.28	13	2 08 01.198 ^s 110.573	13 35 02.83 ^s 747.26
14	0 44 12.529 ^s 104.926	3 07 24.20 ^s 836.45	14	2 09 51.771 ^s 110.779	13 47 30.09 ^s 744.23
15	0 45 57.455 ^s 104.956	3 21 20.65 ^s 835.58	15	2 11 42.550 ^s 110.989	13 59 54.32 ^s 741.14
16	0 47 42.411 ^s 104.989	3 35 16.23 ^s 834.67	16	2 13 33.539 ^s 111.202	14 12 15.46 ^s 737.99
17	0 49 27.400 ^s 105.028	3 49 10.90 ^s 833.71	17	2 15 24.741 ^s 111.418	14 24 33.45 ^s 734.80
18	0 51 12.428 ^s 105.070	4 03 04.61 ^s 832.71	18	2 17 16.159 ^s 111.637	14 36 48.25 ^s 731.56
19	0 52 57.498 ^s 105.117	4 16 57.32 ^s 831.67	19	2 19 07.796 ^s 111.858	14 48 59.81 ^s 728.26
20	0 54 42.615 ^s 105.167	4 30 48.99 ^s 830.58	20	2 20 59.654 ^s 112.084	15 01 08.07 ^s 724.90
21	0 56 27.782 ^s 105.222	4 44 39.57 ^s 829.45	21	2 22 51.738 ^s 112.311	15 13 12.97 ^s 721.51
22	0 58 13.004 ^s 105.281	4 58 29.02 ^s 828.28	22	2 24 44.049 ^s 112.543	15 25 14.48 ^s 718.05
23	0 59 58.285 ^s 105.344	+ 5 12 17.30 ^s +827.07	23	2 26 36.592 ^s 112.776	+15 37 12.53 ^s +714.54
November 14			November 16		
0	1 01 43.629 ^s 105.410	+ 5 26 04.37 ^s +825.81	0	2 28 29.368 ^s 113.012	+15 49 07.07 ^s +710.98
1	1 03 29.039 ^s 105.482	5 39 50.18 ^s 824.51	1	2 30 22.380 ^s 113.251	16 00 58.05 ^s 707.36
2	1 05 14.521 ^s 105.557	5 53 34.69 ^s 823.16	2	2 32 15.631 ^s 113.494	16 12 45.41 ^s 703.69
3	1 07 00.078 ^s 105.635	6 07 17.85 ^s 821.78	3	2 34 09.125 ^s 113.738	16 24 29.10 ^s 699.97
4	1 08 45.713 ^s 105.719	6 20 59.63 ^s 820.34	4	2 36 02.863 ^s 113.985	16 36 09.07 ^s 696.18
5	1 10 31.432 ^s 105.806	6 34 39.97 ^s 818.86	5	2 37 56.848 ^s 114.235	16 47 45.25 ^s 692.36
6	1 12 17.238 ^s 105.897	6 48 18.83 ^s 817.35	6	2 39 51.083 ^s 114.488	16 59 17.61 ^s 688.46
7	1 14 03.135 ^s 105.991	7 01 56.18 ^s 815.78	7	2 41 45.571 ^s 114.742	17 10 46.07 ^s 684.52
8	1 15 49.126 ^s 106.091	7 15 31.96 ^s 814.17	8	2 43 40.313 ^s 115.000	17 22 10.59 ^s 680.52
9	1 17 35.217 ^s 106.193	7 29 06.13 ^s 812.51	9	2 45 35.313 ^s 115.259	17 33 31.11 ^s 676.47
10	1 19 21.410 ^s 106.300	7 42 38.64 ^s 810.82	10	2 47 30.572 ^s 115.521	17 44 47.58 ^s 672.36
11	1 21 07.710 ^s 106.410	7 56 09.46 ^s 809.07	11	2 49 26.093 ^s 115.786	17 55 59.94 ^s 668.19
12	1 22 54.120 ^s 106.525	8 09 38.53 ^s 807.28	12	2 51 21.879 ^s 116.052	18 07 08.13 ^s 663.97
13	1 24 40.645 ^s 106.643	8 23 05.81 ^s 805.45	13	2 53 17.931 ^s 116.321	18 18 12.10 ^s 659.69
14	1 26 27.288 ^s 106.764	8 36 31.26 ^s 803.57	14	2 55 14.252 ^s 116.591	18 29 11.79 ^s 655.35
15	1 28 14.052 ^s 106.891	8 49 54.83 ^s 801.64	15	2 57 10.843 ^s 116.864	18 40 07.14 ^s 650.96
16	1 30 00.943 ^s 107.020	9 03 16.47 ^s 799.67	16	2 59 07.707 ^s 117.139	18 50 58.10 ^s 646.52
17	1 31 47.963 ^s 107.154	9 16 36.14 ^s 797.66	17	3 01 04.846 ^s 117.416	19 01 44.62 ^s 642.00
18	1 33 35.117 ^s 107.291	9 29 53.80 ^s 795.59	18	3 03 02.262 ^s 117.694	19 12 26.62 ^s 637.44
19	1 35 22.408 ^s 107.431	9 43 09.39 ^s 793.47	19	3 04 59.956 ^s 117.975	19 23 04.06 ^s 632.83
20	1 37 09.839 ^s 107.576	9 56 22.86 ^s 791.32	20	3 06 57.931 ^s 118.257	19 33 36.89 ^s 628.14
21	1 38 57.415 ^s 107.724	10 09 34.18 ^s 789.12	21	3 08 56.188 ^s 118.540	19 44 05.03 ^s 623.40
22	1 40 45.139 ^s 107.876	10 22 43.30 ^s 786.86	22	3 10 54.728 ^s 118.826	19 54 28.43 ^s 618.62
23	1 42 33.015 ^s 108.031	10 35 50.16 ^s +784.56	23	3 12 53.554 ^s 119.113	20 04 47.05 ^s +613.76
24	1 44 21.046 ^s	+10 48 54.72 ^s	24	3 14 52.667 ^s	+20 15 00.81 ^s

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
November 17			November 19		
h	h m s		h	h m s	
0	3 14 52.667	+20 15 00.81	0	4 55 56.614	+26 31 50.63
1	3 16 52.068	20 25 09.65	1	4 58 09.870	26 36 55.70
2	3 18 51.759	20 35 13.53	2	5 00 23.375	26 41 53.10
3	3 20 51.740	20 45 12.39	3	5 02 37.126	26 46 42.79
4	3 22 52.014	20 55 06.15	4	5 04 51.119	26 51 24.73
5	3 24 52.582	21 04 54.78	5	5 07 05.351	26 55 58.85
6	3 26 53.443	21 14 38.20	6	5 09 19.818	27 00 25.13
7	3 28 54.601	21 24 16.35	7	5 11 34.516	27 04 43.51
8	3 30 56.054	21 33 49.19	8	5 13 49.442	27 08 53.95
9	3 32 57.805	21 43 16.64	9	5 16 04.591	27 12 56.41
10	3 34 59.854	21 52 38.66	10	5 18 19.960	27 16 50.84
11	3 37 02.201	22 01 55.18	11	5 20 35.544	27 20 37.20
12	3 39 04.848	22 11 06.15	12	5 22 51.339	27 24 15.46
13	3 41 07.794	22 20 11.50	13	5 25 07.342	27 27 45.56
14	3 43 11.041	22 29 11.17	14	5 27 23.547	27 31 07.47
15	3 45 14.587	22 38 05.11	15	5 29 39.950	27 34 21.16
16	3 47 18.435	22 46 53.26	16	5 31 56.547	27 37 26.58
17	3 49 22.583	22 55 35.56	17	5 34 13.332	27 40 23.71
18	3 51 27.032	23 04 11.95	18	5 36 30.302	27 43 12.49
19	3 53 31.782	23 12 42.36	19	5 38 47.452	27 45 52.90
20	3 55 36.833	23 21 06.76	20	5 41 04.776	27 48 24.90
21	3 57 42.184	23 29 25.06	21	5 43 22.269	27 50 48.46
22	3 59 47.835	23 37 37.23	22	5 45 39.928	27 53 03.55
23	4 01 53.786	+23 45 43.19	23	5 47 57.746	+27 55 10.14
	126.250	+479.70		137.972	+118.05
November 18			November 20		
0	4 04 00.036	+23 53 42.89	0	5 50 15.718	+27 57 08.19
1	4 06 06.585	24 01 36.27	1	5 52 33.840	27 58 57.67
2	4 08 13.431	24 09 23.27	2	5 54 52.106	28 00 38.57
3	4 10 20.574	24 17 03.85	3	5 57 10.511	28 02 10.85
4	4 12 28.014	24 24 37.93	4	5 59 29.050	28 03 34.48
5	4 14 35.748	24 32 05.46	5	6 01 47.716	28 04 49.44
6	4 16 43.777	24 39 26.39	6	6 04 06.506	28 05 55.71
7	4 18 52.098	24 46 40.65	7	6 06 25.412	28 06 53.26
8	4 21 00.710	24 53 48.20	8	6 08 44.430	28 07 42.07
9	4 23 09.612	25 00 48.97	9	6 11 03.554	28 08 22.13
10	4 25 18.802	25 07 42.92	10	6 13 22.779	28 08 53.40
11	4 27 28.279	25 14 29.97	11	6 15 42.099	28 09 15.87
12	4 29 38.041	25 21 10.09	12	6 18 01.508	28 09 29.53
13	4 31 48.086	25 27 43.21	13	6 20 21.000	28 09 34.35
14	4 33 58.411	25 34 09.28	14	6 22 40.571	28 09 30.33
15	4 36 09.016	25 40 28.25	15	6 25 00.213	28 09 17.45
16	4 38 19.898	25 46 40.06	16	6 27 19.923	28 08 55.69
17	4 40 31.054	25 52 44.66	17	6 29 39.693	28 08 25.04
18	4 42 42.482	25 58 42.00	18	6 31 59.518	28 07 45.49
19	4 44 54.179	26 04 32.02	19	6 34 19.392	28 06 57.04
20	4 47 06.143	26 10 14.68	20	6 36 39.311	28 05 59.67
21	4 49 18.372	26 15 49.92	21	6 38 59.267	28 04 53.38
22	4 51 30.862	26 21 17.69	22	6 41 19.255	28 03 38.16
23	4 53 43.610	26 26 37.94	23	6 43 39.270	28 02 14.01
24	4 55 56.614	+26 31 50.63	24	6 45 59.305	+28 00 40.91
	133.004	+312.69		140.035	-93.10

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
November 21									November 23								
h	h	m	s	s	°	'	"	"	h	h	m	s	s	°	'	"	"
0	6 45	59	305	140-051	+28 00	40	91	-102-03	0	8 36	46	583	135-276	+23 54	18	66	-513-50
1	6 48	19	356	140-061	27 58	58	88	110-98	1	8 39	01	859	135-098	23 45	45	16	521-31
2	6 50	39	417	140-064	27 57	07	90	119-92	2	8 41	16	957	134-919	23 37	03	85	529-09
3	6 52	59	481	140-063	27 55	07	98	128-87	3	8 43	31	876	134-739	23 28	14	76	536-83
4	6 55	19	544	140-055	27 52	59	11	137-80	4	8 45	46	615	134-557	23 19	17	93	544-51
5	6 57	39	599	140-043	27 50	41	31	146-74	5	8 48	01	172	134-375	23 10	13	42	552-16
6	6 59	59	642	140-024	27 48	14	57	155-68	6	8 50	15	547	134-191	23 01	01	26	559-76
7	7 02	19	666	140-001	27 45	38	89	164-60	7	8 52	29	738	134-007	22 51	41	50	567-31
8	7 04	39	667	139-972	27 42	54	29	173-53	8	8 54	43	745	133-822	22 42	14	19	574-82
9	7 06	59	639	139-938	27 40	00	76	182-44	9	8 56	57	567	133-636	22 32	39	37	582-27
10	7 09	19	577	139-898	27 36	58	32	191-34	10	8 59	11	203	133-451	22 22	57	10	589-69
11	7 11	39	475	139-854	27 33	46	98	200-25	11	9 01	24	654	133-264	22 13	07	41	597-04
12	7 13	59	329	139-803	27 30	26	73	209-12	12	9 03	37	918	133-077	22 03	10	37	604-36
13	7 16	19	132	139-748	27 26	57	61	218-01	13	9 05	50	995	132-891	21 53	06	01	611-62
14	7 18	38	880	139-688	27 23	19	60	226-86	14	9 08	03	886	132-704	21 42	54	39	618-84
15	7 20	58	568	139-623	27 19	32	74	235-71	15	9 10	16	590	132-517	21 32	35	55	626-00
16	7 23	18	191	139-554	27 15	37	03	244-54	16	9 12	29	107	132-331	21 22	09	55	633-12
17	7 25	37	745	139-478	27 11	32	49	253-36	17	9 14	41	438	132-145	21 11	36	43	640-18
18	7 27	57	223	139-399	27 07	19	13	262-15	18	9 16	53	583	131-960	21 00	56	25	647-18
19	7 30	16	622	139-315	27 02	56	98	270-94	19	9 19	05	543	131-774	20 50	09	07	654-15
20	7 32	35	937	139-226	26 58	26	04	279-69	20	9 21	17	317	131-590	20 39	14	92	661-06
21	7 34	55	163	139-133	26 53	46	35	288-44	21	9 23	28	907	131-407	20 28	13	86	667-91
22	7 37	14	296	139-035	26 48	57	91	297-16	22	9 25	40	314	131-224	20 17	05	95	674-71
23	7 39	33	331	138-933	+26 44	00	75	-305-85	23	9 27	51	538	131-041	+20 05	51	24	-681-46
November 22									November 24								
0	7 41	52	264	138-827	+26 38	54	90	-314-53	0	9 30	02	579	130-862	+19 54	29	78	-688-16
1	7 44	11	091	138-717	26 33	40	37	323-18	1	9 32	13	441	130-681	19 43	01	62	694-80
2	7 46	29	808	138-603	26 28	17	19	331-81	2	9 34	24	122	130-504	19 31	26	82	701-38
3	7 48	48	411	138-484	26 22	45	38	340-40	3	9 36	34	626	130-326	19 19	45	44	707-91
4	7 51	06	895	138-362	26 17	04	98	348-98	4	9 38	44	952	130-151	19 07	57	53	714-39
5	7 53	25	257	138-236	26 11	16	00	357-52	5	9 40	55	103	129-977	18 56	03	14	720-81
6	7 55	43	493	138-106	26 05	18	48	366-04	6	9 43	05	080	129-805	18 44	02	33	727-17
7	7 58	01	599	137-974	25 59	12	44	374-52	7	9 45	14	885	129-635	18 31	55	16	733-49
8	8 00	19	573	137-837	25 52	57	92	382-98	8	9 47	24	520	129-466	18 19	41	67	739-73
9	8 02	37	410	137-697	25 46	34	94	391-41	9	9 49	33	986	129-300	18 07	21	94	745-93
10	8 04	55	107	137-554	25 40	03	53	399-80	10	9 51	43	286	129-134	17 54	56	01	752-07
11	8 07	12	661	137-408	25 33	23	73	408-15	11	9 53	52	420	128-973	17 42	23	94	758-15
12	8 09	30	069	137-258	25 26	35	58	416-49	12	9 56	01	393	128-812	17 29	45	79	764-17
13	8 11	47	327	137-107	25 19	39	09	424-77	13	9 58	10	205	128-654	17 17	01	62	770-14
14	8 14	04	434	136-952	25 12	34	32	433-03	14	10 00	18	859	128-499	17 04	11	48	776-04
15	8 16	21	386	136-794	25 05	21	29	441-26	15	10 02	27	358	128-345	16 51	15	44	781-89
16	8 18	38	180	136-634	24 58	00	03	449-43	16	10 04	35	703	128-195	16 38	13	55	787-68
17	8 20	54	814	136-472	24 50	50	30	457-58	17	10 06	43	898	128-048	16 25	05	87	793-41
18	8 23	11	286	136-307	24 42	53	02	465-69	18	10 08	51	946	127-902	16 11	52	46	799-08
19	8 25	27	593	136-140	24 35	07	33	473-76	19	10 10	59	848	127-759	15 58	33	38	804-68
20	8 27	43	733	135-971	24 27	13	57	481-78	20	10 13	07	607	127-621	15 45	08	70	810-24
21	8 29	59	704	135-799	24 19	11	79	489-78	21	10 15	15	228	127-483	15 31	38	46	815-73
22	8 32	15	503	135-627	24 11	02	01	497-72	22	10 17	22	711	127-351	15 18	02	73	821-15
23	8 34	31	130	135-453	24 02	44	29	-505-63	23	10 19	30	062	127-220	15 04	21	58	-826-52
24	8 36	46	583		+23 54	18	66		24	10 21	37	282		+14 50	35	06	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
November 25							November 27						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	10	21	37.282	127.092	+ 14	50 35.06	0	12	02	07.087	125.884	+ 2	25 43.39
1	10	23	44.374	126.969	- 831.82	1	12	04	12.971	125.978	2	08 56.97	1006.42
2	10	25	51.343	126.848	837.07	2	12	06	18.949	126.080	1	52 08.78	1008.19
3	10	27	58.191	126.731	842.25	3	12	08	25.029	126.185	1	35 18.90	1009.88
4	10	30	04.922	126.618	847.37	4	12	10	31.214	126.298	1	18 27.42	1011.48
5	10	32	11.540	126.507	852.42	5	12	12	37.512	126.414	1	01 34.44	1012.98
6	10	34	18.047	126.400	857.41	6	12	14	43.926	126.537	0	44 40.03	1014.41
7	10	36	24.447	126.298	862.35	7	12	16	50.463	126.666	0	27 44.30	1015.73
8	10	38	30.745	126.198	867.20	8	12	18	57.129	126.799	+ 0	10 47.32	1016.98
9	10	40	36.943	126.103	872.01	9	12	21	03.928	126.939	- 0	06 10.81	1018.13
10	10	42	43.046	126.011	876.75	10	12	23	10.867	127.083	0	23 10.00	1019.19
11	10	44	49.057	125.924	881.41	11	12	25	17.950	127.234	0	23 10.00	1020.15
12	10	46	54.981	125.839	886.02	12	12	27	25.184	127.390	0	40 10.15	1021.03
13	10	49	00.820	125.760	890.56	13	12	29	32.574	127.552	0	57 11.18	1021.80
14	10	51	06.580	125.685	895.03	14	12	31	40.126	127.719	1	14 12.98	1022.49
15	10	53	12.265	125.613	899.44	15	12	33	47.845	127.892	1	31 15.47	1023.08
16	10	55	17.878	125.546	903.78	16	12	35	55.737	128.071	1	48 18.55	1023.57
17	10	57	23.424	125.483	908.06	17	12	38	03.808	128.254	2	05 22.12	1023.96
18	10	59	28.907	125.424	912.26	18	12	40	12.062	128.445	2	22 26.08	1024.26
19	11	01	34.331	125.370	916.39	19	12	42	20.507	128.639	2	39 30.34	1024.46
20	11	03	39.701	125.320	920.47	20	12	44	29.146	128.841	2	56 34.80	1024.55
21	11	05	45.021	125.274	924.46	21	12	46	37.987	129.047	3	13 39.35	1024.55
22	11	07	50.295	125.233	928.40	22	12	48	47.034	129.259	3	30 43.90	1024.45
23	11	09	55.528	125.197	932.25	23	12	50	56.293	129.477	3	47 48.35	1024.23
					+ 9	11 29.88					- 4	04 52.58	- 1023.93
November 26							November 28						
0	11	12	00.725	125.165	+ 8	55 53.83	0	12	53	05.770	129.700	- 4	21 56.51
1	11	14	05.890	125.138	- 939.76	1	12	55	15.470	129.928	4	39 00.02	- 1023.51
2	11	16	11.028	125.116	943.42	2	12	57	25.398	130.163	4	56 03.00	- 1022.98
3	11	18	16.144	125.097	946.99	3	12	59	35.561	130.403	5	13 05.36	- 1022.36
4	11	20	21.241	125.085	950.49	4	13	01	45.964	130.648	5	30 06.99	- 1021.63
5	11	22	26.326	125.076	953.93	5	13	03	56.612	130.899	5	47 07.77	- 1020.78
6	11	24	31.402	125.073	957.28	6	13	06	07.511	131.155	5	47 07.77	- 1019.83
7	11	26	36.475	125.075	960.57	7	13	08	18.666	131.416	6	04 07.60	- 1018.77
8	11	28	41.550	125.081	963.78	8	13	10	30.082	131.684	6	21 06.37	- 1017.60
9	11	30	46.631	125.093	966.91	9	13	12	41.766	131.956	6	38 03.97	- 1017.60
10	11	32	51.724	125.109	969.98	10	13	14	53.722	132.234	6	55 00.29	- 1016.32
11	11	34	56.833	125.130	972.95	11	13	17	05.956	132.517	7	11 55.21	- 1014.92
12	11	37	01.963	125.157	975.87	12	13	19	18.473	132.805	7	28 48.62	- 1013.41
13	11	39	07.120	125.189	978.70	13	13	21	31.278	133.098	7	45 40.41	- 1011.79
14	11	41	12.309	125.226	981.45	14	13	23	44.376	133.398	8	02 30.47	- 1010.06
15	11	43	17.535	125.268	984.12	15	13	25	57.774	133.701	8	19 18.67	- 1008.20
16	11	45	22.803	125.315	986.72	16	13	28	11.475	134.010	8	36 04.90	- 1006.23
17	11	47	28.118	125.367	989.24	17	13	30	25.485	134.323	8	52 49.04	- 1004.14
18	11	49	33.485	125.425	991.67	18	13	32	39.808	134.643	8	52 49.04	- 1001.93
19	11	51	38.910	125.488	994.02	19	13	34	54.451	134.966	9	09 30.97	- 999.61
20	11	53	44.398	125.557	996.30	20	13	37	09.417	135.295	9	26 10.58	- 997.16
21	11	55	49.955	125.630	998.50	21	13	39	24.712	135.628	9	42 47.74	- 994.60
22	11	57	55.585	125.709	1000.60	22	13	41	40.340	135.967	9	59 22.34	- 991.91
23	12	00	01.294	125.793	1002.62	23	13	43	56.307	136.309	10	15 54.25	- 989.09
24	12	02	07.087	125.884	1004.57	24	13	46	12.616	136.652	10	32 23.34	- 986.16
					+ 2	25 43.39					- 11	05 12.61	- 983.11

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination					
November 29									December 1										
h	m	s	°	'	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
0	13	46	12.616	136.656	-11	05	12.61	0	15	43	01.556	156.229	-22	28	55.15	0	15	45	
1	13	48	29.272	137.008	11	21	32.53	1	15	45	37.785	156.624	22	40	06.82	1	15	47	
2	13	50	46.280	137.365	11	37	49.13	2	15	48	14.409	157.014	22	51	08.87	2	15	49	
3	13	53	03.645	137.725	11	54	02.31	3	15	50	51.423	157.400	23	02	01.16	3	15	51	
4	13	55	21.370	138.089	12	10	11.92	4	15	53	28.823	157.780	23	12	43.59	4	15	54	
5	13	57	39.459	138.459	12	26	17.84	5	15	56	06.603	158.154	23	23	16.03	5	15	57	
6	13	59	57.918	138.831	12	42	19.94	6	15	58	44.757	158.525	23	33	38.37	6	16	00	
7	14	02	16.749	139.209	12	58	18.09	7	16	01	23.282	158.888	23	43	50.51	7	16	02	
8	14	04	35.958	139.589	13	14	12.16	8	16	04	02.170	159.246	23	53	52.32	8	16	05	
9	14	06	55.547	139.974	13	30	02.02	9	16	06	41.416	159.598	24	03	43.70	9	16	07	
10	14	09	15.521	140.361	13	45	47.54	10	16	09	21.014	159.942	24	13	24.54	10	16	09	
11	14	11	35.882	140.754	14	01	28.59	11	16	12	00.956	160.281	24	22	54.75	11	16	12	
12	14	13	56.636	141.148	14	17	05.04	12	16	14	41.237	160.612	24	32	14.20	12	16	14	
13	14	16	17.784	141.547	14	32	36.75	13	16	17	21.849	160.935	24	41	22.82	13	16	17	
14	14	18	39.331	141.947	14	48	03.59	14	16	20	02.784	161.251	24	50	20.49	14	16	20	
15	14	21	01.278	142.353	15	03	25.43	15	16	22	44.035	161.560	24	59	07.12	15	16	22	
16	14	23	23.631	142.759	15	18	42.13	16	16	25	25.595	161.859	25	07	42.62	16	16	25	
17	14	25	46.390	143.169	15	33	53.56	17	16	28	07.454	162.150	25	16	06.89	17	16	28	
18	14	28	09.559	143.582	15	48	59.58	18	16	30	49.604	162.433	25	24	19.85	18	16	30	
19	14	30	33.141	143.997	16	04	00.06	19	16	33	32.037	162.707	25	32	21.42	19	16	33	
20	14	32	57.138	144.414	16	18	54.86	20	16	36	14.744	162.971	25	40	11.50	20	16	36	
21	14	35	21.552	144.833	16	33	43.85	21	16	38	57.715	163.226	25	47	50.01	21	16	38	
22	14	37	46.385	145.254	16	48	26.90	22	16	41	40.941	163.472	25	55	16.89	22	16	41	
23	14	40	11.639	145.677	-17	03	03.86	23	16	44	24.413	163.708	-26	02	32.04	23	16	44	
November 30									December 2										
0	14	42	37.316	146.101	-17	17	34.60	0	16	47	08.121	163.933	-26	09	35.41	0	16	47	
1	14	45	03.417	146.527	17	31	58.98	1	16	49	52.054	164.148	26	16	26.91	1	16	49	
2	14	47	29.944	146.955	17	46	16.87	2	16	52	36.202	164.353	26	23	06.49	2	16	52	
3	14	49	56.899	147.382	18	00	28.13	3	16	55	20.555	164.547	26	29	34.08	3	16	55	
4	14	52	24.281	147.812	18	14	32.63	4	16	58	05.102	164.730	26	35	49.62	4	16	58	
5	14	54	52.093	148.241	18	28	30.22	5	17	00	49.832	164.902	26	41	53.05	5	17	00	
6	14	57	20.334	148.671	18	42	20.78	6	17	03	34.734	165.062	26	47	44.31	6	17	03	
7	14	59	49.005	149.101	18	56	04.17	7	17	06	19.796	165.211	26	53	23.36	7	17	06	
8	15	02	18.106	149.532	19	09	40.25	8	17	09	05.007	165.349	26	58	50.14	8	17	09	
9	15	04	47.638	149.961	19	23	08.88	9	17	11	50.356	165.474	27	04	04.62	9	17	11	
10	15	07	17.599	150.391	19	36	29.94	10	17	14	35.830	165.588	27	09	06.75	10	17	14	
11	15	09	47.990	150.820	19	49	43.29	11	17	17	21.418	165.690	27	13	56.48	11	17	17	
12	15	12	18.810	151.249	20	02	48.79	12	17	20	07.108	165.779	27	18	33.80	12	17	20	
13	15	14	50.059	151.675	20	15	46.32	13	17	22	52.887	165.856	27	22	58.65	13	17	22	
14	15	17	21.734	152.101	20	28	35.73	14	17	25	38.743	165.921	27	27	11.02	14	17	25	
15	15	19	53.835	152.525	20	41	16.90	15	17	28	24.664	165.973	27	31	10.88	15	17	28	
16	15	22	26.360	152.947	20	53	49.70	16	17	31	10.637	166.012	27	34	58.21	16	17	31	
17	15	24	59.307	153.368	21	06	13.99	17	17	33	56.649	166.040	27	38	32.99	17	17	33	
18	15	27	32.675	153.785	21	18	29.65	18	17	36	42.689	166.053	27	41	55.21	18	17	36	
19	15	30	06.460	154.201	21	30	36.54	19	17	39	28.742	166.054	27	45	04.85	19	17	39	
20	15	32	40.661	154.613	21	42	34.55	20	17	42	14.796	166.043	27	48	01.90	20	17	42	
21	15	35	15.274	155.022	21	54	23.54	21	17	45	00.839	166.018	27	50	46.37	21	17	45	
22	15	37	50.296	155.429	22	06	03.38	22	17	47	46.857	165.981	27	53	18.25	22	17	47	
23	15	40	25.725	155.831	22	17	33.96	23	17	50	32.838	165.930	27	55	37.53	23	17	50	
24	15	43	01.556		-22	28	55.15	24	17	53	18.768		-27	57	44.24	24	17	53	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
December 3							December 5						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	17	53	18.768	165.867	-27 57 44.24	-114.13	0	20 01 14.098	150.005	-25 46 53.84	+422.97		
1	17	56	04.635	165.791	27 59 38.37	101.57	1	20 03 44.103	149.494	25 39 50.87	431.92		
2	17	58	50.426	165.701	28 01 19.94	89.02	2	20 06 13.597	148.978	25 32 38.95	440.76		
3	18	01	36.127	165.600	28 02 48.96	76.50	3	20 08 42.575	148.459	25 25 18.19	449.49		
4	18	04	21.727	165.485	28 04 05.46	63.99	4	20 11 11.034	147.937	25 17 48.70	458.11		
5	18	07	07.212	165.357	28 05 09.45	51.52	5	20 13 38.971	147.415	25 10 10.59	466.62		
6	18	09	52.569	165.217	28 06 00.97	39.06	6	20 16 06.386	146.888	25 02 23.97	475.01		
7	18	12	37.786	165.064	28 06 40.03	26.64	7	20 18 33.274	146.360	24 54 28.96	483.29		
8	18	15	22.850	164.898	28 07 06.67	14.27	8	20 20 59.634	145.830	24 46 25.67	491.45		
9	18	18	07.748	164.721	28 07 20.94	-1.91	9	20 23 25.464	145.299	24 38 14.22	499.52		
10	18	20	52.469	164.530	28 07 22.85	+10.38	10	20 25 50.763	144.766	24 29 54.70	507.46		
11	18	23	36.999	164.328	28 07 12.47	22.65	11	20 28 15.529	144.233	24 21 27.24	515.28		
12	18	26	21.327	164.113	28 06 49.82	34.86	12	20 30 39.762	143.699	24 12 51.96	523.01		
13	18	29	05.440	163.886	28 06 14.96	47.02	13	20 33 03.461	143.163	24 04 08.95	530.61		
14	18	31	49.326	163.649	28 05 27.94	59.13	14	20 35 26.624	142.628	23 55 18.34	538.11		
15	18	34	32.975	163.398	28 04 28.81	71.18	15	20 37 49.252	142.093	23 46 20.23	545.50		
16	18	37	16.373	163.137	28 03 17.63	83.18	16	20 40 11.345	141.556	23 37 14.73	552.76		
17	18	39	59.510	162.864	28 01 54.45	95.11	17	20 42 32.901	141.021	23 28 01.97	559.93		
18	18	42	42.374	162.580	28 00 19.34	106.98	18	20 44 53.922	140.487	23 18 42.04	566.98		
19	18	45	24.954	162.286	27 58 32.36	118.78	19	20 47 14.409	139.951	23 09 15.06	573.92		
20	18	48	07.240	161.979	27 56 33.58	130.51	20	20 49 34.360	139.419	22 59 41.14	580.76		
21	18	50	49.219	161.664	27 54 23.07	142.18	21	20 51 53.779	138.885	22 50 00.38	587.47		
22	18	53	30.883	161.337	27 52 00.89	153.76	22	20 54 12.664	138.354	22 40 12.91	594.10		
23	18	56	12.220	161.000	-27 49 27.13	+165.28	23	20 56 31.018	137.824	-22 30 18.81	+600.60		
December 4							December 6						
0	18	58	53.220	160.654	-27 46 41.85	+176.70	0	20 58 48.842	137.295	-22 20 18.21	+607.00		
1	19	01	33.874	160.297	27 43 45.15	188.06	1	21 01 06.137	136.768	22 10 11.21	613.30		
2	19	04	14.171	159.932	27 40 37.09	199.33	2	21 03 22.905	136.243	21 59 57.91	619.48		
3	19	06	54.103	159.556	27 37 17.76	210.51	3	21 05 39.148	135.720	21 49 38.43	625.57		
4	19	09	33.659	159.173	27 33 47.25	221.61	4	21 07 54.868	135.199	21 39 12.86	631.54		
5	19	12	12.832	158.780	27 30 05.64	232.62	5	21 10 10.067	134.680	21 28 41.32	637.43		
6	19	14	51.612	158.379	27 26 13.02	243.53	6	21 12 24.747	134.163	21 18 03.89	643.19		
7	19	17	29.991	157.969	27 22 09.49	254.37	7	21 14 38.910	133.650	21 07 20.70	648.87		
8	19	20	07.960	157.553	27 17 55.12	265.09	8	21 16 52.560	133.138	20 56 31.83	654.43		
9	19	22	45.513	157.127	27 13 30.03	275.73	9	21 19 05.698	132.631	20 45 37.40	659.90		
10	19	25	22.640	156.695	27 08 54.30	286.27	10	21 21 18.329	132.124	20 34 37.50	665.27		
11	19	27	59.335	156.254	27 04 08.03	296.72	11	21 23 30.453	131.623	20 23 32.23	670.55		
12	19	30	35.589	155.809	26 59 11.31	307.05	12	21 25 42.076	131.123	20 12 21.68	675.71		
13	19	33	11.398	155.355	26 54 04.26	317.29	13	21 27 53.199	130.628	20 01 05.97	680.79		
14	19	35	46.753	154.895	26 48 46.97	327.43	14	21 30 03.827	130.135	19 49 45.18	685.77		
15	19	38	21.648	154.429	26 43 19.54	337.47	15	21 32 13.962	129.646	19 38 19.41	690.65		
16	19	40	56.077	153.958	26 37 42.07	347.39	16	21 34 23.608	129.161	19 26 48.76	695.44		
17	19	43	30.035	153.481	26 31 54.68	357.22	17	21 36 32.769	128.680	19 15 13.32	700.13		
18	19	46	03.516	152.998	26 25 57.46	366.94	18	21 38 41.449	128.201	19 03 33.19	704.74		
19	19	48	36.514	152.510	26 19 50.52	376.55	19	21 40 49.650	127.728	18 51 48.45	709.26		
20	19	51	09.024	152.018	26 13 33.97	386.05	20	21 42 57.378	127.258	18 39 59.19	713.67		
21	19	53	41.042	151.521	26 07 07.92	395.45	21	21 45 04.636	126.792	18 28 05.52	718.00		
22	19	56	12.563	151.020	26 00 32.47	404.73	22	21 47 11.428	126.330	18 16 07.52	722.25		
23	19	58	43.583	150.515	25 53 47.74	+413.90	23	21 49 17.758	125.872	18 04 05.27	+726.40		
24	20	01	14.098		-25 46 53.84		24	21 51 23.630		-17 51 58.87			

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
December 7			December 9		
h	h m s	° ' "	h	h m s	° ' "
0	21 51 23.630 ^s 125.420	-17 51 58.87 ^s +730.47	0	23 24 41.635 ^s 109.468	-7 14 22.42 ^s +840.77
1	21 53 29.050 ^s 124.970	17 39 48.40 ^s 734.44	1	23 26 31.103 ^s 109.263	7 00 21.65 ^s 841.61
2	21 55 34.020 ^s 124.526	17 27 33.96 ^s 738.35	2	23 28 20.366 ^s 109.064	6 46 20.04 ^s 842.41
3	21 57 38.546 ^s 124.087	17 15 15.61 ^s 742.16	3	23 30 09.430 ^s 108.869	6 32 17.63 ^s 843.16
4	21 59 42.633 ^s 123.650	17 02 53.45 ^s 745.89	4	23 31 58.299 ^s 108.679	6 18 14.47 ^s 843.86
5	22 01 46.283 ^s 123.220	16 50 27.56 ^s 749.53	5	23 33 46.978 ^s 108.495	6 04 10.61 ^s 844.51
6	22 03 49.503 ^s 122.793	16 37 58.03 ^s 753.10	6	23 35 35.473 ^s 108.316	5 50 06.10 ^s 845.11
7	22 05 52.296 ^s 122.372	16 25 24.93 ^s 756.58	7	23 37 23.789 ^s 108.143	5 36 00.99 ^s 845.68
8	22 07 54.668 ^s 121.955	16 12 48.35 ^s 759.99	8	23 39 11.932 ^s 107.973	5 21 55.31 ^s 846.19
9	22 09 56.623 ^s 121.544	16 00 08.36 ^s 763.32	9	23 40 59.905 ^s 107.810	5 07 49.12 ^s 846.65
10	22 11 58.167 ^s 121.136	15 47 25.04 ^s 766.57	10	23 42 47.715 ^s 107.651	4 53 42.47 ^s 847.08
11	22 13 59.303 ^s 120.733	15 34 38.47 ^s 769.74	11	23 44 35.366 ^s 107.497	4 39 35.39 ^s 847.45
12	22 16 00.036 ^s 120.337	15 21 48.73 ^s 772.83	12	23 46 22.863 ^s 107.350	4 25 27.94 ^s 847.79
13	22 18 00.373 ^s 119.944	15 08 55.90 ^s 775.86	13	23 48 10.213 ^s 107.206	4 11 20.15 ^s 848.08
14	22 20 00.317 ^s 119.556	14 56 00.04 ^s 778.81	14	23 49 57.419 ^s 107.067	3 57 12.07 ^s 848.31
15	22 21 59.873 ^s 119.174	14 43 01.23 ^s 781.68	15	23 51 44.486 ^s 106.935	3 43 03.76 ^s 848.53
16	22 23 59.047 ^s 118.797	14 29 59.55 ^s 784.49	16	23 53 31.421 ^s 106.806	3 28 55.23 ^s 848.67
17	22 25 57.844 ^s 118.424	14 16 55.06 ^s 787.21	17	23 55 18.227 ^s 106.683	3 14 46.56 ^s 848.80
18	22 27 56.268 ^s 118.057	14 03 47.85 ^s 789.88	18	23 57 04.910 ^s 106.565	3 00 37.76 ^s 848.86
19	22 29 54.325 ^s 117.695	13 50 37.97 ^s 792.47	19	23 58 51.475 ^s 106.451	2 46 28.90 ^s 848.90
20	22 31 52.020 ^s 117.338	13 37 25.50 ^s 794.99	20	00 00 37.926 ^s 106.344	2 32 20.00 ^s 848.88
21	22 33 49.358 ^s 116.986	13 24 10.51 ^s 797.44	21	00 02 24.270 ^s 106.240	2 18 11.12 ^s 848.83
22	22 35 46.344 ^s 116.640	13 10 53.07 ^s 799.83	22	00 04 10.510 ^s 106.142	2 04 02.29 ^s 848.73
23	22 37 42.984 ^s 116.298	-12 57 33.24 ^s +802.15	23	00 05 56.652 ^s 106.049	-1 49 53.56 ^s +848.59
December 8			December 10		
0	22 39 39.282 ^s 115.961	-12 44 11.09 ^s +804.41	0	00 07 42.701 ^s 105.960	-1 35 44.97 ^s +848.42
1	22 41 35.243 ^s 115.631	12 30 46.68 ^s 806.60	1	00 09 28.661 ^s 105.877	1 21 36.55 ^s 848.19
2	22 43 30.874 ^s 115.305	12 17 20.08 ^s 808.72	2	00 11 14.538 ^s 105.798	1 07 28.36 ^s 847.94
3	22 45 26.179 ^s 114.984	12 03 51.36 ^s 810.79	3	00 13 00.336 ^s 105.724	0 53 20.42 ^s 847.64
4	22 47 21.163 ^s 114.669	11 50 20.57 ^s 812.79	4	00 14 46.060 ^s 105.655	0 39 12.78 ^s 847.29
5	22 49 15.832 ^s 114.359	11 36 47.78 ^s 814.73	5	00 16 31.715 ^s 105.592	0 25 05.49 ^s 846.91
6	22 51 10.191 ^s 114.054	11 23 13.05 ^s 816.61	6	00 18 17.307 ^s 105.532	-0 10 58.58 ^s 846.49
7	22 53 04.245 ^s 113.755	11 09 36.44 ^s 818.42	7	00 20 02.839 ^s 105.477	+0 03 07.91 ^s 846.03
8	22 54 58.000 ^s 113.460	10 55 58.02 ^s 820.19	8	00 21 48.316 ^s 105.428	0 17 13.94 ^s 845.53
9	22 56 51.460 ^s 113.171	10 42 17.83 ^s 821.88	9	00 23 33.744 ^s 105.384	0 31 19.47 ^s 844.99
10	22 58 44.631 ^s 112.888	10 28 35.95 ^s 823.53	10	00 25 19.128 ^s 105.343	0 45 24.46 ^s 844.41
11	23 00 37.519 ^s 112.609	10 14 52.42 ^s 825.11	11	00 27 04.471 ^s 105.308	0 59 28.87 ^s 843.78
12	23 02 30.128 ^s 112.336	10 01 07.31 ^s 826.64	12	00 28 49.779 ^s 105.278	1 13 32.65 ^s 843.13
13	23 04 22.464 ^s 112.068	9 47 20.67 ^s 828.11	13	00 30 35.057 ^s 105.251	1 27 35.78 ^s 842.43
14	23 06 14.532 ^s 111.805	9 33 32.56 ^s 829.52	14	00 32 20.308 ^s 105.231	1 41 38.21 ^s 841.69
15	23 08 06.337 ^s 111.548	9 19 43.04 ^s 830.89	15	00 34 05.539 ^s 105.214	1 55 39.90 ^s 840.92
16	23 09 57.885 ^s 111.296	9 05 52.15 ^s 832.20	16	00 35 50.753 ^s 105.203	2 09 40.82 ^s 840.09
17	23 11 49.181 ^s 111.049	8 51 59.95 ^s 833.44	17	00 37 35.956 ^s 105.195	2 23 40.91 ^s 839.24
18	23 13 40.230 ^s 110.807	8 38 06.51 ^s 834.65	18	00 39 21.151 ^s 105.193	2 37 40.15 ^s 838.35
19	23 15 31.037 ^s 110.572	8 24 11.86 ^s 835.80	19	00 41 06.344 ^s 105.196	2 51 38.50 ^s 837.41
20	23 17 21.609 ^s 110.340	8 10 16.06 ^s 836.89	20	00 42 51.540 ^s 105.202	3 05 35.91 ^s 836.44
21	23 19 11.949 ^s 110.114	7 56 19.17 ^s 837.94	21	00 44 36.742 ^s 105.214	3 19 32.35 ^s 835.43
22	23 21 02.063 ^s 109.894	7 42 21.23 ^s 838.93	22	00 46 21.956 ^s 105.230	3 33 27.78 ^s 834.37
23	23 22 51.957 ^s 109.678	7 28 22.30 ^s +839.88	23	00 48 07.186 ^s 105.250	3 47 22.15 ^s +833.29
24	23 24 41.635 ^s	-7 14 22.42 ^s	24	00 49 52.436 ^s	+4 01 15.44

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
December 11			December 13		
h	h m s	° ' " "	h	h m s	° ' " "
0	0 49 52.436 ^s 105.276	+ 4 01 15.44 ["] +832.15	0	2 15 54.125 ^s 111.493	+14 33 15.17 ["] +729.14
1	0 51 37.712 ^s 105.305	4 15 07.59 ["] 830.99	1	2 17 45.618 ^s 111.716	14 45 24.31 ["] 725.89
2	0 53 23.017 ^s 105.340	4 28 58.58 ["] 829.78	2	2 19 37.334 ^s 111.945	14 57 30.20 ["] 722.58
3	0 55 08.357 ^s 105.379	4 42 48.36 ["] 828.53	3	2 21 29.279 ^s 112.176	15 09 32.78 ["] 719.23
4	0 56 53.736 ^s 105.421	4 56 36.89 ["] 827.24	4	2 23 21.455 ^s 112.410	15 21 32.01 ["] 715.83
5	0 58 39.157 ^s 105.470	5 10 24.13 ["] 825.92	5	2 25 13.865 ^s 112.648	15 33 27.84 ["] 712.36
6	1 00 24.627 ^s 105.522	5 24 10.05 ["] 824.55	6	2 27 06.513 ^s 112.889	15 45 20.20 ["] 708.86
7	1 02 10.149 ^s 105.579	5 37 54.60 ["] 823.14	7	2 28 59.402 ^s 113.133	15 57 09.06 ["] 705.30
8	1 03 55.728 ^s 105.639	5 51 37.74 ["] 821.70	8	2 30 52.535 ^s 113.381	16 08 54.36 ["] 701.69
9	1 05 41.367 ^s 105.706	6 05 19.44 ["] 820.22	9	2 32 45.916 ^s 113.630	16 20 36.05 ["] 698.03
10	1 07 27.073 ^s 105.775	6 18 59.66 ["] 818.69	10	2 34 39.546 ^s 113.884	16 32 14.08 ["] 694.30
11	1 09 12.848 ^s 105.849	6 32 38.35 ["] 817.12	11	2 36 33.430 ^s 114.141	16 43 48.38 ["] 690.54
12	1 10 58.697 ^s 105.929	6 46 15.47 ["] 815.52	12	2 38 27.571 ^s 114.399	16 55 18.92 ["] 686.72
13	1 12 44.626 ^s 106.011	6 59 50.99 ["] 813.87	13	2 40 21.970 ^s 114.662	17 06 45.64 ["] 682.83
14	1 14 30.637 ^s 106.099	7 13 24.86 ["] 812.19	14	2 42 16.632 ^s 114.927	17 18 08.47 ["] 678.91
15	1 16 16.736 ^s 106.190	7 26 57.05 ["] 810.46	15	2 44 11.559 ^s 115.194	17 29 27.38 ["] 674.92
16	1 18 02.926 ^s 106.286	7 40 27.51 ["] 808.69	16	2 46 06.753 ^s 115.465	17 40 42.30 ["] 670.88
17	1 19 49.212 ^s 106.387	7 53 56.20 ["] 806.88	17	2 48 02.218 ^s 115.738	17 51 53.18 ["] 666.79
18	1 21 35.599 ^s 106.491	8 07 23.08 ["] 805.03	18	2 49 57.956 ^s 116.014	18 02 59.97 ["] 662.63
19	1 23 22.090 ^s 106.600	8 20 48.11 ["] 803.13	19	2 51 53.970 ^s 116.292	18 14 02.60 ["] 658.43
20	1 25 08.690 ^s 106.712	8 34 11.24 ["] 801.20	20	2 53 50.262 ^s 116.573	18 25 01.03 ["] 654.16
21	1 26 55.402 ^s 106.830	8 47 32.44 ["] 799.23	21	2 55 46.835 ^s 116.856	18 35 55.19 ["] 649.85
22	1 28 42.232 ^s 106.951	9 00 51.67 ["] 797.21	22	2 57 43.691 ^s 117.141	18 46 45.04 ["] 645.48
23	1 30 29.183 ^s 107.077	+ 9 14 08.88 ["] +795.15	23	2 59 40.832 ^s 117.429	+18 57 30.52 ["] +641.04
December 12			December 14		
0	1 32 16.260 ^s 107.206	+ 9 27 24.03 ["] +793.05	0	3 01 38.261 ^s 117.720	+19 08 11.56 ["] +636.55
1	1 34 03.466 ^s 107.340	9 40 37.08 ["] 790.90	1	3 03 35.981 ^s 118.011	19 18 48.11 ["] 632.00
2	1 35 50.806 ^s 107.478	9 53 47.98 ["] 788.71	2	3 05 33.992 ^s 118.306	19 29 20.11 ["] 627.41
3	1 37 38.284 ^s 107.619	10 06 56.69 ["] 786.48	3	3 07 32.298 ^s 118.602	19 39 47.52 ["] 622.73
4	1 39 25.903 ^s 107.766	10 20 03.17 ["] 784.20	4	3 09 30.900 ^s 118.900	19 50 10.25 ["] 618.02
5	1 41 13.669 ^s 107.915	10 33 07.37 ["] 781.89	5	3 11 29.800 ^s 119.201	20 00 28.27 ["] 613.24
6	1 43 01.584 ^s 108.069	10 46 09.26 ["] 779.52	6	3 13 29.001 ^s 119.502	20 10 41.51 ["] 608.41
7	1 44 49.653 ^s 108.228	10 59 08.78 ["] 777.12	7	3 15 28.503 ^s 119.806	20 20 49.92 ["] 603.50
8	1 46 37.881 ^s 108.389	11 12 05.90 ["] 774.66	8	3 17 28.309 ^s 120.112	20 30 53.42 ["] 598.56
9	1 48 26.270 ^s 108.554	11 25 00.56 ["] 772.17	9	3 19 28.421 ^s 120.418	20 40 51.98 ["] 593.53
10	1 50 14.824 ^s 108.725	11 37 52.73 ["] 769.63	10	3 21 28.839 ^s 120.727	20 50 45.51 ["] 588.46
11	1 52 03.549 ^s 108.898	11 50 42.36 ["] 767.04	11	3 23 29.566 ^s 121.036	21 00 33.97 ["] 583.33
12	1 53 52.447 ^s 109.075	12 03 29.40 ["] 764.40	12	3 25 30.602 ^s 121.348	21 10 17.30 ["] 578.13
13	1 55 41.522 ^s 109.257	12 16 13.80 ["] 761.73	13	3 27 31.950 ^s 121.660	21 19 55.43 ["] 572.88
14	1 57 30.779 ^s 109.441	12 28 55.53 ["] 759.01	14	3 29 33.610 ^s 121.973	21 29 28.31 ["] 567.57
15	1 59 20.220 ^s 109.630	12 41 34.54 ["] 756.23	15	3 31 35.583 ^s 122.288	21 38 55.88 ["] 562.19
16	2 01 09.850 ^s 109.823	12 54 10.77 ["] 753.41	16	3 33 37.871 ^s 122.604	21 48 18.07 ["] 556.75
17	2 02 59.673 ^s 110.018	13 06 44.18 ["] 750.55	17	3 35 40.475 ^s 122.919	21 57 34.82 ["] 551.25
18	2 04 49.691 ^s 110.219	13 19 14.73 ["] 747.64	18	3 37 43.394 ^s 123.237	22 06 46.07 ["] 545.70
19	2 06 39.910 ^s 110.422	13 31 42.37 ["] 744.67	19	3 39 46.631 ^s 123.555	22 15 51.77 ["] 540.08
20	2 08 30.332 ^s 110.629	13 44 07.04 ["] 741.67	20	3 41 50.186 ^s 123.873	22 24 51.85 ["] 534.40
21	2 10 20.961 ^s 110.839	13 56 28.71 ["] 738.60	21	3 43 54.059 ^s 124.192	22 33 46.25 ["] 528.66
22	2 12 11.800 ^s 111.054	14 08 47.31 ["] 735.51	22	3 45 58.251 ^s 124.512	22 42 34.91 ["] 522.85
23	2 14 02.854 ^s 111.271	14 21 02.82 ["] +732.35	23	3 48 02.763 ^s 124.831	22 51 17.76 ["] +517.00
24	2 15 54.125 ^s	+14 33 15.17 ["]	24	3 50 07.594 ^s	+22 59 54.76 ["]

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
December 15							December 17						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	3	50	07.594	125.150	+22	59 54.76	0	5	35	52.991	138.485	+27	39 08.50
1	3	52	12.744	125.471		23 08 25.82	1	5	38	11.476	138.673		27 41 47.16
2	3	54	18.215	125.790		23 16 50.90	2	5	40	30.149	138.856		27 44 17.28
3	3	56	24.005	126.110		23 25 09.94	3	5	42	49.005	139.034		27 46 38.79
4	3	58	30.115	126.430		23 33 22.86	4	5	45	08.039	139.206		27 48 51.68
5	4	00	36.545	126.749		23 41 29.61	5	5	47	27.245	139.371		27 50 55.91
6	4	02	43.294	127.067		23 49 30.14	6	5	49	46.616	139.532		27 52 51.43
7	4	04	50.361	127.385		23 57 24.36	7	5	52	06.148	139.687		27 54 38.23
8	4	06	57.746	127.703		24 05 12.24	8	5	54	25.835	139.835		27 56 16.27
9	4	09	05.449	128.020		24 12 53.70	9	5	56	45.670	139.978		27 57 45.52
10	4	11	13.469	128.335		24 20 28.68	10	5	59	05.648	140.114		27 59 05.95
11	4	13	21.804	128.650		24 27 57.13	11	6	01	25.762	140.245		28 00 17.54
12	4	15	30.454	128.963		24 35 18.98	12	6	03	46.007	140.370		28 01 20.25
13	4	17	39.417	129.276		24 42 34.17	13	6	06	06.377	140.487		28 02 14.06
14	4	19	48.693	129.587		24 49 42.65	14	6	08	26.864	140.600		28 02 58.96
15	4	21	58.280	129.896		24 56 44.35	15	6	10	47.464	140.706		28 03 34.91
16	4	24	08.176	130.204		25 03 39.21	16	6	13	08.170	140.805		28 04 01.90
17	4	26	18.380	130.510		25 10 27.17	17	6	15	28.975	140.898		28 04 19.90
18	4	28	28.890	130.814		25 17 08.17	18	6	17	49.873	140.985		28 04 28.91
19	4	30	39.704	131.117		25 23 42.17	19	6	20	10.858	141.065		28 04 28.89
20	4	32	50.821	131.416		25 30 09.08	20	6	22	31.923	141.140		28 04 19.83
21	4	35	02.237	131.715		25 36 28.87	21	6	24	53.063	141.206		28 04 01.73
22	4	37	13.952	132.010		25 42 41.47	22	6	27	14.269	141.268		28 03 34.56
23	4	39	25.962	132.304		+25 48 46.82	23	6	29	35.537	141.322		+28 02 58.31
						+358.04							-45.33
December 16							December 18						
0	4	41	38.266	132.594	+25	54 44.86	0	6	31	56.859	141.370	+28	02 12.98
1	4	43	50.860	132.881		26 00 35.55	1	6	34	18.229	141.412		28 01 18.56
2	4	46	03.741	133.167		26 06 18.82	2	6	36	39.641	141.446		28 00 15.02
3	4	48	16.908	133.449		26 11 54.61	3	6	39	01.087	141.475		27 59 02.38
4	4	50	30.357	133.728		26 17 22.88	4	6	41	22.562	141.498		27 57 40.62
5	4	52	44.085	134.004		26 22 43.57	5	6	43	44.060	141.513		27 56 09.75
6	4	54	58.089	134.277		26 27 56.62	6	6	46	05.573	141.522		27 54 29.75
7	4	57	12.366	134.545		26 33 01.99	7	6	48	27.095	141.525		27 52 40.63
8	4	59	26.911	134.811		26 37 59.61	8	6	50	48.620	141.521		27 50 42.38
9	5	01	41.722	135.073		26 42 49.44	9	6	53	10.141	141.511		27 48 35.01
10	5	03	56.795	135.331		26 47 31.42	10	6	55	31.652	141.495		27 46 18.53
11	5	06	12.126	135.585		26 52 05.51	11	6	57	53.147	141.472		27 43 52.93
12	5	08	27.711	135.836		26 56 31.66	12	7	00	14.619	141.443		27 41 18.22
13	5	10	43.547	136.081		27 00 49.80	13	7	02	36.062	141.408		27 38 34.41
14	5	12	59.628	136.323		27 04 59.91	14	7	04	57.470	141.367		27 35 41.50
15	5	15	15.951	136.561		27 09 01.92	15	7	07	18.837	141.320		27 32 39.51
16	5	17	32.512	136.794		27 12 55.80	16	7	09	40.157	141.266		27 29 28.45
17	5	19	49.306	137.022		27 16 41.49	17	7	12	01.423	141.207		27 26 08.33
18	5	22	06.328	137.246		27 20 18.95	18	7	14	22.630	141.142		27 22 39.16
19	5	24	23.574	137.465		27 23 48.14	19	7	16	43.772	141.070		27 19 00.96
20	5	26	41.039	137.679		27 27 09.01	20	7	19	04.842	140.993		27 15 13.74
21	5	28	58.718	137.889		27 30 21.53	21	7	21	25.835	140.911		27 11 17.53
22	5	31	16.607	138.092		27 33 25.64	22	7	23	46.746	140.823		27 07 12.33
23	5	33	34.699	138.292		27 36 21.31	23	7	26	07.569	140.729		27 02 58.18
24	5	35	52.991			+27 39 08.50	24	7	28	28.298			+26 58 35.09
						+167.19							-263.09

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
December 19							December 21						
b	h	m	s	°	'	"	b	h	m	s	°	'	"
0	7 28	28.298	140.629	+26 58	35.09	-272.01	0	9 17	50.580	131.611	+20 44	24.05	-653.42
1	7 30	48.927	140.525	26 54	03.08	280.89	1	9 20	02.191	131.385	20 33	30.63	660.08
2	7 33	09.452	140.414	26 49	22.19	289.77	2	9 22	13.576	131.159	20 22	30.55	666.67
3	7 35	29.866	140.300	26 44	32.42	298.60	3	9 24	24.735	130.934	20 11	23.88	673.22
4	7 37	50.166	140.180	26 39	33.82	307.42	4	9 26	35.669	130.711	20 00	10.66	679.69
5	7 40	10.346	140.054	26 34	26.40	316.20	5	9 28	46.380	130.487	19 48	50.97	686.10
6	7 42	30.400	139.924	26 29	10.20	324.96	6	9 30	56.867	130.264	19 37	24.87	692.45
7	7 44	50.324	139.789	26 23	45.24	333.68	7	9 33	07.131	130.044	19 25	52.42	698.74
8	7 47	10.113	139.649	26 18	11.56	342.37	8	9 35	17.175	129.823	19 14	13.68	704.97
9	7 49	29.762	139.506	26 12	29.19	351.03	9	9 37	26.998	129.605	19 02	28.71	711.13
10	7 51	49.268	139.356	26 06	38.16	359.66	10	9 39	36.603	129.388	18 50	37.58	717.22
11	7 54	08.624	139.204	26 00	38.50	368.24	11	9 41	45.991	129.171	18 38	40.36	723.26
12	7 56	27.828	139.046	25 54	30.26	376.80	12	9 43	55.162	128.958	18 26	37.10	729.23
13	7 58	46.874	138.885	25 48	13.46	385.32	13	9 46	04.120	128.745	18 14	27.87	735.14
14	8 01	05.759	138.719	25 41	48.14	393.79	14	9 48	12.865	128.534	18 02	12.73	740.98
15	8 03	24.478	138.551	25 35	14.35	402.23	15	9 50	21.399	128.325	17 49	51.75	746.76
16	8 05	43.029	138.377	25 28	32.12	410.63	16	9 52	29.724	128.119	17 37	24.99	752.47
17	8 08	01.406	138.200	25 21	41.49	418.99	17	9 54	37.843	127.913	17 24	52.52	758.11
18	8 10	19.606	138.020	25 14	42.50	427.30	18	9 56	45.756	127.712	17 12	14.41	763.70
19	8 12	37.626	137.837	25 07	35.20	435.57	19	9 58	53.468	127.511	16 59	30.71	769.22
20	8 14	55.463	137.650	25 00	19.63	443.81	20	10 01	00.979	127.313	16 46	41.49	774.67
21	8 17	13.113	137.459	24 52	55.82	451.98	21	10 03	08.292	127.117	16 33	46.82	780.06
22	8 19	30.572	137.267	24 45	23.84	460.13	22	10 05	15.409	126.925	16 20	46.76	785.38
23	8 21	47.839	137.071	+24 37	43.71	-468.21	23	10 07	22.334	126.734	+16 07	41.38	-790.64
December 20							December 22						
0	8 24	04.910	136.872	+24 29	55.50	-476.26	0	10 09	29.068	126.547	+15 54	30.74	-795.83
1	8 26	21.782	136.670	24 21	59.24	484.26	1	10 11	35.615	126.362	15 41	14.91	800.95
2	8 28	38.452	136.467	24 13	54.98	492.20	2	10 13	41.977	126.180	15 27	53.96	806.01
3	8 30	54.919	136.261	24 05	42.78	500.10	3	10 15	48.157	126.002	15 14	27.95	811.01
4	8 33	11.180	136.052	23 57	22.68	507.95	4	10 17	54.159	125.825	15 00	56.94	815.93
5	8 35	27.232	135.842	23 48	54.73	515.75	5	10 19	59.984	125.653	14 47	21.01	820.79
6	8 37	43.074	135.629	23 40	18.98	523.49	6	10 22	05.637	125.483	14 33	40.22	825.58
7	8 39	58.703	135.414	23 31	35.49	531.18	7	10 24	11.120	125.316	14 19	54.64	830.31
8	8 42	14.117	135.199	23 22	44.31	538.83	8	10 26	16.436	125.154	14 06	04.33	834.97
9	8 44	29.316	134.981	23 13	45.48	546.41	9	10 28	21.590	124.994	13 52	09.36	839.57
10	8 46	44.297	134.762	23 04	39.07	553.94	10	10 30	26.584	124.838	13 38	09.79	844.10
11	8 48	59.059	134.541	22 55	25.13	561.42	11	10 32	31.422	124.686	13 24	05.69	848.55
12	8 51	13.600	134.319	22 46	03.71	568.84	12	10 34	36.108	124.536	13 09	57.14	852.95
13	8 53	27.919	134.097	22 36	34.87	576.21	13	10 36	40.644	124.392	12 55	44.19	857.27
14	8 55	42.016	133.872	22 26	58.66	583.52	14	10 38	45.036	124.249	12 41	26.92	861.54
15	8 57	55.888	133.649	22 17	15.14	590.77	15	10 40	49.285	124.113	12 27	05.38	865.72
16	9 00	09.537	133.423	22 07	24.37	597.97	16	10 42	53.398	123.978	12 12	39.66	869.85
17	9 02	22.960	133.197	21 57	26.40	605.11	17	10 44	57.376	123.848	11 58	09.81	873.91
18	9 04	36.157	132.970	21 47	21.29	612.18	18	10 47	01.224	123.722	11 43	35.90	877.90
19	9 06	49.127	132.745	21 37	09.11	619.21	19	10 49	04.946	123.601	11 28	58.00	881.83
20	9 09	01.872	132.517	21 26	49.90	626.17	20	10 51	08.547	123.483	11 14	16.17	885.67
21	9 11	14.389	132.291	21 16	23.73	633.07	21	10 53	12.030	123.369	10 59	30.50	889.47
22	9 13	26.680	132.063	21 05	50.66	639.91	22	10 55	15.399	123.259	10 44	41.03	893.18
23	9 15	38.743	131.837	20 55	10.75	-646.70	23	10 57	18.658	123.155	10 29	47.85	-896.83
24	9 17	50.580		+20 44	24.05		24	10 59	21.813		+10 14	51.02	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
December 23			December 25		
h	h m s	° ' "	h	h m s	° ' "
0	10 59 21.813 ^s	+10 14 51.02 ["]	0	12 37 23.895 ^s	- 2 31 12.34 ["]
1	11 01 24.867 ^s	9 59 50.60 ["]	1	12 39 27.964 ^s	2 47 40.54 ["]
2	11 03 27.824 ^s	9 44 46.67 ["]	2	12 41 32.187 ^s	3 04 08.69 ["]
3	11 05 30.689 ^s	9 29 39.29 ["]	3	12 43 36.570 ^s	3 20 36.70 ["]
4	11 07 33.467 ^s	9 14 28.54 ["]	4	12 45 41.118 ^s	3 37 04.48 ["]
5	11 09 36.161 ^s	8 59 14.47 ["]	5	12 47 45.839 ^s	3 53 31.96 ["]
6	11 11 38.778 ^s	8 43 57.17 ["]	6	12 49 50.736 ^s	4 09 59.03 ["]
7	11 13 41.320 ^s	8 28 36.69 ["]	7	12 51 55.816 ^s	4 26 25.62 ["]
8	11 15 43.793 ^s	8 13 13.11 ["]	8	12 54 01.086 ^s	4 42 51.65 ["]
9	11 17 46.202 ^s	7 57 46.50 ["]	9	12 56 06.549 ^s	4 59 17.01 ["]
10	11 19 48.550 ^s	7 42 16.93 ["]	10	12 58 12.213 ^s	5 15 41.62 ["]
11	11 21 50.844 ^s	7 26 44.46 ["]	11	13 00 18.082 ^s	5 32 05.40 ["]
12	11 23 53.088 ^s	7 11 09.16 ["]	12	13 02 24.163 ^s	5 48 28.25 ["]
13	11 25 55.286 ^s	6 55 31.12 ["]	13	13 04 30.460 ^s	6 04 50.08 ["]
14	11 27 57.444 ^s	6 39 50.39 ["]	14	13 06 36.981 ^s	6 21 10.80 ["]
15	11 29 59.566 ^s	6 24 07.04 ["]	15	13 08 43.730 ^s	6 37 30.32 ["]
16	11 32 01.658 ^s	6 08 21.16 ["]	16	13 10 50.713 ^s	6 53 48.55 ["]
17	11 34 03.725 ^s	5 52 32.80 ["]	17	13 12 57.935 ^s	7 10 05.39 ["]
18	11 36 05.771 ^s	5 36 42.04 ["]	18	13 15 05.403 ^s	7 26 20.75 ["]
19	11 38 07.801 ^s	5 20 48.95 ["]	19	13 17 13.121 ^s	7 42 34.53 ["]
20	11 40 09.822 ^s	5 04 53.60 ["]	20	13 19 21.096 ^s	7 58 46.65 ["]
21	11 42 11.837 ^s	4 48 56.07 ["]	21	13 21 29.333 ^s	8 14 56.99 ["]
22	11 44 13.853 ^s	4 32 56.42 ["]	22	13 23 37.837 ^s	8 31 05.47 ["]
23	11 46 15.873 ^s	+ 4 16 54.73 ["]	23	13 25 46.613 ^s	- 8 47 11.99 ["]
	122-032	-963.65		129-055	-964.46
December 24			December 26		
h	h m s	° ' "	h	h m s	° ' "
0	11 48 17.905 ^s	+ 4 00 51.08 ["]	0	13 27 55.668 ^s	- 9 03 16.45 ["]
1	11 50 19.952 ^s	3 44 45.52 ["]	1	13 30 05.007 ^s	9 19 18.74 ["]
2	11 52 22.021 ^s	3 28 38.15 ["]	2	13 32 14.635 ^s	9 35 18.78 ["]
3	11 54 24.115 ^s	3 12 29.02 ["]	3	13 34 24.556 ^s	9 51 16.46 ["]
4	11 56 26.242 ^s	2 56 18.22 ["]	4	13 36 34.778 ^s	10 07 11.68 ["]
5	11 58 28.406 ^s	2 40 05.82 ["]	5	13 38 45.304 ^s	10 23 04.33 ["]
6	12 00 30.612 ^s	2 23 51.89 ["]	6	13 40 56.141 ^s	10 38 54.32 ["]
7	12 02 32.867 ^s	2 07 36.52 ["]	7	13 43 07.292 ^s	10 54 41.54 ["]
8	12 04 35.175 ^s	1 51 19.76 ["]	8	13 45 18.764 ^s	11 10 25.88 ["]
9	12 06 37.542 ^s	1 35 01.71 ["]	9	13 47 30.561 ^s	11 26 07.25 ["]
10	12 08 39.973 ^s	1 18 42.43 ["]	10	13 49 42.689 ^s	11 41 45.53 ["]
11	12 10 42.474 ^s	1 02 22.00 ["]	11	13 51 55.151 ^s	11 57 20.62 ["]
12	12 12 45.051 ^s	0 46 00.51 ["]	12	13 54 07.954 ^s	12 12 52.41 ["]
13	12 14 47.709 ^s	0 29 38.02 ["]	13	13 56 21.102 ^s	12 28 20.80 ["]
14	12 16 50.453 ^s	+ 0 13 14.61 ["]	14	13 58 34.599 ^s	12 43 45.67 ["]
15	12 18 53.290 ^s	- 0 03 09.63 ["]	15	14 00 48.451 ^s	12 59 06.92 ["]
16	12 20 56.224 ^s	0 19 34.63 ["]	16	14 03 02.661 ^s	13 14 24.44 ["]
17	12 22 59.262 ^s	0 36 00.31 ["]	17	14 05 17.235 ^s	13 29 38.11 ["]
18	12 25 02.409 ^s	0 52 26.59 ["]	18	14 07 32.177 ^s	13 44 47.83 ["]
19	12 27 05.670 ^s	1 08 53.39 ["]	19	14 09 47.491 ^s	13 59 53.48 ["]
20	12 29 09.052 ^s	1 25 20.63 ["]	20	14 12 03.181 ^s	14 14 54.95 ["]
21	12 31 12.560 ^s	1 41 48.22 ["]	21	14 14 19.252 ^s	14 29 52.12 ["]
22	12 33 16.199 ^s	1 58 16.09 ["]	22	14 16 35.707 ^s	14 44 44.89 ["]
23	12 35 19.976 ^s	2 14 44.16 ["]	23	14 18 52.551 ^s	14 59 33.14 ["]
24	12 37 23.895 ^s	- 2 31 12.34 ["]	24	14 21 09.787 ^s	-15 14 16.75 ["]
	123-919	-988.18		137-236	-883.61

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
December 27			December 29		
h	h m s	° ' "	h	h m s	° ' "
0	14 21 09.787	-15 14 16.75	0	16 19 16.895	-24 51 16.37
1	14 23 27.419	15 28 55.60	1	16 21 54.753	24 59 46.78
2	14 25 45.451	15 43 29.59	2	16 24 32.970	25 08 06.73
3	14 28 03.887	15 57 58.59	3	16 27 11.539	25 16 16.12
4	14 30 22.729	16 12 22.49	4	16 29 50.455	25 24 14.85
5	14 32 41.981	16 26 41.16	5	16 32 29.708	25 32 02.83
6	14 35 01.646	16 40 54.50	6	16 35 09.293	25 39 39.98
7	14 37 21.727	16 55 02.38	7	16 37 49.200	25 47 06.19
8	14 39 42.227	17 09 04.68	8	16 40 29.423	25 54 21.40
9	14 42 03.148	17 23 01.28	9	16 43 09.952	26 01 25.50
10	14 44 24.494	17 36 52.06	10	16 45 50.780	26 08 18.42
11	14 46 46.267	17 50 56.91	11	16 48 31.897	26 15 00.08
12	14 49 08.468	18 04 15.70	12	16 51 13.294	26 21 30.40
13	14 51 31.100	18 17 48.30	13	16 53 54.963	26 27 49.30
14	14 53 54.166	18 31 14.61	14	16 56 36.893	26 33 56.72
15	14 56 17.666	18 44 34.49	15	16 59 19.075	26 39 52.58
16	14 58 41.602	18 57 47.83	16	17 02 01.500	26 45 36.81
17	15 01 05.976	19 10 54.50	17	17 04 44.155	26 51 09.36
18	15 03 30.790	19 23 54.39	18	17 07 27.033	26 56 30.15
19	15 05 56.043	19 36 47.36	19	17 10 10.120	27 01 39.13
20	15 08 21.737	19 49 33.30	20	17 12 53.408	27 06 36.24
21	15 10 47.873	20 02 12.08	21	17 15 36.885	27 11 21.43
22	15 13 14.451	20 14 43.58	22	17 18 20.539	27 15 54.65
23	15 15 41.472	-20 27 07.69	23	17 21 04.360	-27 20 15.84
	147.463	-736.58		163.976	-249.13
December 28			December 30		
h	h m s	° ' "	h	h m s	° ' "
0	15 18 08.935	-20 39 24.27	0	17 23 48.336	-27 24 24.97
1	15 20 36.840	20 51 33.21	1	17 26 32.456	27 28 21.99
2	15 23 05.187	21 03 34.39	2	17 29 16.707	27 32 06.87
3	15 25 33.976	21 15 27.68	3	17 32 01.077	27 35 39.56
4	15 28 03.205	21 27 12.96	4	17 34 45.555	27 39 00.03
5	15 30 32.873	21 38 50.12	5	17 37 30.128	27 42 08.26
6	15 33 02.980	21 50 19.03	6	17 40 14.785	27 45 04.23
7	15 35 33.523	22 01 39.57	7	17 42 59.511	27 47 47.89
8	15 38 04.501	22 12 51.63	8	17 45 44.296	27 50 19.25
9	15 40 35.912	22 23 55.08	9	17 48 29.126	27 52 38.27
10	15 43 07.754	22 34 49.80	10	17 51 13.989	27 54 44.95
11	15 45 40.024	22 45 35.69	11	17 53 58.872	27 56 39.28
12	15 48 12.720	22 56 12.63	12	17 56 43.762	27 58 21.24
13	15 50 45.838	23 06 40.49	13	17 59 28.647	27 59 50.85
14	15 53 19.375	23 16 59.17	14	18 02 13.514	28 01 08.08
15	15 55 53.327	23 27 08.55	15	18 04 58.349	28 02 12.96
16	15 58 27.692	23 37 08.52	16	18 07 43.140	28 03 05.48
17	16 01 02.464	23 46 58.97	17	18 10 27.875	28 03 45.66
18	16 03 37.640	23 56 39.78	18	18 13 12.540	28 04 13.51
19	16 06 13.215	24 06 10.85	19	18 15 57.122	28 04 29.04
20	16 08 49.184	24 15 32.08	20	18 18 41.609	28 04 32.27
21	16 11 25.542	24 24 43.34	21	18 21 25.988	28 04 23.24
22	16 14 02.284	24 33 44.55	22	18 24 10.246	28 04 01.95
23	16 16 39.404	24 42 35.59	23	18 26 54.371	28 03 28.44
24	16 19 16.895	-24 51 16.37	24	18 29 38.351	-28 02 42.75
	157.491	-520.78		163.980	+45.69

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
December 31							December 31						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	18	29	38.351	163.821	-28	02 42.75	12	19	02	10.333	161.001	-27	37 59.67
1	18	32	22.172	163.650	28	01 44.91	13	19	04	51.334	160.693	27	34 39.82
2	18	35	05.822	163.468	28	00 34.95	14	19	07	32.027	160.376	27	31 08.55
3	18	37	49.290	163.273	27	59 12.92	15	19	10	12.403	160.049	27	27 25.92
4	18	40	32.563	163.067	27	57 38.86	16	19	12	52.452	159.711	27	23 32.01
5	18	43	15.630	162.848	27	55 52.82	17	19	15	32.163	159.366	27	19 26.90
6	18	45	58.478	162.617	27	53 54.85	18	19	18	11.529	159.009	27	15 10.66
7	18	48	41.095	162.376	27	51 45.01	19	19	20	50.538	158.644	27	10 43.39
8	18	51	23.471	162.123	27	49 23.34	20	19	23	29.182	158.271	27	06 05.17
9	18	54	05.594	161.859	27	46 49.91	21	19	26	07.453	157.888	27	01 16.08
10	18	56	47.453	161.583	27	44 04.78	22	19	28	45.341	157.497	26	56 16.21
11	18	59	29.036	161.297	27	41 08.01	23	19	31	22.838	157.099	26	51 05.66
12	19	02	10.333		-27	37 59.67	24	19	33	59.937		-26	45 44.51

PHASES OF THE MOON

Lunation	New Moon			First Quarter			Full Moon			Last Quarter		
	d	h	m	d	h	m	d	h	m	d	h	m
544	Dec.	12	03 14	Dec.	19	21 41	Dec.	27	17 44	Jan.	3	14 19
545	Jan.	10	18 06	Jan.	18	19 42	Jan.	26	06 41	Feb.	1	23 03
546	Feb.	9	10 44	Feb.	17	15 57	Feb.	24	17 44	Mar.	3	09 11
547	Mar.	11	04 30	Mar.	19	08 32	Mar.	26	03 21	Apr.	1	20 59
548	Apr.	9	22 21	Apr.	17	20 48	Apr.	24	12 04	May	1	10 33
549	May	9	14 56	May	17	05 18	May	23	20 23	May	31	01 52
550	June	8	05 14	June	15	11 12	June	22	04 57	June	29	18 40
551	July	7	17 01	July	14	15 53	July	21	14 40	July	29	12 15
552	Aug.	6	02 49	Aug.	12	20 45	Aug.	20	02 27	Aug.	28	05 35
553	Sept.	4	11 38	Sept.	11	03 06	Sept.	18	17 00	Sept.	26	21 44
554	Oct.	3	20 24	Oct.	10	12 11	Oct.	18	10 11	Oct.	26	12 04
555	Nov.	2	05 49	Nov.	9	01 00	Nov.	17	04 53	Nov.	25	00 24
556	Dec.	1	16 10	Dec.	8	17 58	Dec.	16	23 22	Dec.	24	10 48
557	Dec.	31	03 39	Jan.	7	14 23	Jan.	15	16 12	Jan.	22	19 38

PERIGEE

APOGEE

	d	h		d	h		d	h		d	h		d	h		d	h
Jan.	1	10	May	22	02	Oct.	4	14	Jan.	16	21	June	3	02	Oct.	19	08
Jan.	28	15	June	18	20	Nov.	2	02	Feb.	13	15	June	30	20	Nov.	15	08
Feb.	25	21	July	14	20	Nov.	30	14	Mar.	13	01	July	28	14	Dec.	12	18
Mar.	26	08	Aug.	9	15	Dec.	28	19	Apr.	9	03	Aug.	25	09	Jan.	9	13
Apr.	23	19	Sept.	6	08				May	6	11	Sept.	22	00			

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
243						
Jan. 0	9490.5	245° 50' 24.9	-2° 09' 45.2	0.464 4959	245.96615	2.78148
1	9491.5	248 35 58.2	2 28 55.1	.465 4637	248.74157	2.76993
2	9492.5	251 21 00.9	2 47 40.3	.466 1532	251.50713	2.76173
3	9493.5	254 05 45.4	3 05 59.8	.466 5642	254.26615	2.75687
4	9494.5	256 50 24.1	3 23 52.5	.466 6959	257.02198	2.75533
5	9495.5	259 35 09.2	-3 41 17.2	0.466 5484	259.77790	2.75706
6	9496.5	262 20 12.8	3 58 12.8	.466 1215	262.53721	2.76212
7	9497.5	265 05 47.2	4 14 37.8	.465 4161	265.30324	2.77049
8	9498.5	267 52 04.6	4 30 30.9	.464 4329	268.07932	2.78224
9	9499.5	270 39 17.6	4 45 50.5	.463 1727	270.86886	2.79741
10	9500.5	273 27 38.7	-5 00 34.8	0.461 6374	273.67530	2.81604
11	9501.5	276 17 20.8	5 14 42.1	.459 8288	276.50213	2.83824
12	9502.5	279 08 36.9	5 28 10.2	.457 7490	279.35299	2.86408
13	9503.5	282 01 40.5	5 40 56.8	.455 4004	282.23155	2.89369
14	9504.5	284 56 45.5	5 52 59.5	.452 7867	285.14168	2.92721
15	9505.5	287 54 06.0	-6 04 15.3	0.449 9118	288.08731	2.96473
16	9506.5	290 53 56.9	6 14 41.4	.446 7794	291.07254	3.00645
17	9507.5	293 56 33.4	6 24 14.2	.443 3948	294.10166	3.05253
18	9508.5	297 02 11.3	6 32 50.1	.439 7636	297.17911	3.10314
19	9509.5	300 11 07.0	6 40 24.9	.435 8923	300.30953	3.15850
20	9510.5	303 23 37.6	-6 46 54.1	0.431 7882	303.49777	3.21883
21	9511.5	306 40 00.9	6 52 13.0	.427 4599	306.74892	3.28435
22	9512.5	310 00 35.4	6 56 16.0	.422 9168	310.06827	3.35529
23	9513.5	313 25 40.3	6 58 57.4	.418 1695	313.46139	3.43191
24	9514.5	316 55 35.4	7 00 10.9	.413 2305	316.93405	3.51443
25	9515.5	320 30 41.2	-6 59 49.7	0.408 1134	320.49230	3.60311
26	9516.5	324 11 19.2	6 57 46.5	.402 8338	324.14240	3.69817
27	9517.5	327 57 50.9	6 53 53.7	.397 4089	327.89084	3.79982
28	9518.5	331 50 38.6	6 48 03.1	.391 8585	331.74430	3.90823
29	9519.5	335 50 04.9	6 40 06.4	.386 2044	335.70959	4.02350
30	9520.5	339 56 32.2	-6 29 54.9	0.380 4712	339.79360	4.14567
31	9521.5	344 10 22.8	6 17 20.0	.374 6858	344.00322	4.27469
Feb. 1	9522.5	348 31 58.3	6 02 13.3	.368 8785	348.34519	4.41034
2	9523.5	353 01 39.4	5 44 26.9	.363 0824	352.82599	4.55227
3	9524.5	357 39 44.8	5 23 53.8	.357 3338	357.45164	4.69991
4	9525.5	2 26 31.2	-5 00 28.3	0.351 6723	2.22745	4.85245
5	9526.5	7 22 11.9	4 34 06.8	.346 1409	7.15781	5.00878
6	9527.5	12 26 56.1	4 04 48.1	.340 7851	12.24579	5.16745
7	9528.5	17 40 48.2	3 32 34.3	.335 6534	17.49289	5.32666
8	9529.5	23 03 46.0	2 57 31.5	.330 7961	22.89857	5.48424
9	9530.5	28 35 40.2	-2 19 50.6	0.326 2656	28.45996	5.63760
10	9531.5	34 16 13.0	1 39 47.7	.322 1139	34.17140	5.78385
11	9532.5	40 04 57.3	0 57 44.7	.318 3923	40.02425	5.91985
12	9533.5	46 01 15.6	-0 14 09.2	.315 1503	46.00658	6.04227
13	9534.5	52 04 20.0	+0 30 25.3	.312 4334	52.10317	6.14782
14	9535.5	58 13 11.8	+1 15 20.9	0.310 2814	58.29556	6.23338
15	9536.5	64 26 42.4	+1 59 55.9	0.308 7277	64.56238	6.29629

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
	243					
Feb. 15	9536.5	64 26 42.4	+1 59 55.9	0.308 7277	64.56238	6.29629
16	9537.5	70 43 34.5	2 43 26.4	.307 7967	70.87988	6.33444
17	9538.5	77 02 23.4	3 25 09.0	.307 5035	77.22256	6.34651
18	9539.5	83 21 40.1	4 04 22.0	.307 8528	83.56408	6.33213
19	9540.5	89 39 53.5	4 40 27.9	.308 8389	89.87815	6.29175
20	9541.5	95 55 33.8	+5 12 55.5	0.310 4460	96.13938	6.22677
21	9542.5	102 07 14.8	5 41 20.3	.312 6488	102.32421	6.13936
22	9543.5	108 13 37.5	6 05 26.0	.315 4133	108.41151	6.03220
23	9544.5	114 13 31.6	6 25 04.0	.318 6991	114.38308	5.90846
24	9545.5	120 05 57.1	6 40 13.2	.322 4601	120.22400	5.77144
25	9546.5	125 50 05.7	+6 50 59.4	0.326 6469	125.92263	5.62443
26	9547.5	131 25 20.4	6 57 33.4	.331 2081	131.47058	5.47058
27	9548.5	136 51 15.7	7 00 10.3	.336 0912	136.86248	5.31278
28	9549.5	142 07 36.4	6 59 08.3	.341 2445	142.09566	5.15354
Mar. 1	9550.5	147 14 16.7	6 54 46.9	.346 6175	147.16979	4.99500
2	9551.5	152 11 18.7	+6 47 26.7	0.352 1623	152.08649	4.83895
3	9552.5	156 58 51.4	6 37 28.1	.357 8331	156.84899	4.68680
4	9553.5	161 37 09.1	6 25 10.9	.363 5874	161.46175	4.53963
5	9554.5	166 06 30.2	6 10 53.6	.369 3859	165.93017	4.39823
6	9555.5	170 27 16.3	5 54 53.6	.375 1925	170.26031	4.26314
7	9556.5	174 39 50.9	+5 37 26.9	0.380 9744	174.45868	4.13472
8	9557.5	178 44 39.2	5 18 47.6	.386 7020	178.53204	4.01315
9	9558.5	182 42 06.7	4 59 08.5	.392 3479	182.48729	3.89849
10	9559.5	186 32 39.5	4 38 41.1	.397 8880	186.33130	3.79067
11	9560.5	190 16 43.2	4 17 35.1	.403 3007	190.07088	3.68961
12	9561.5	193 54 43.3	+3 55 59.5	0.408 5668	193.71271	3.59512
13	9562.5	197 27 04.4	3 34 01.7	.413 6690	197.26323	3.50697
14	9563.5	200 54 10.3	3 11 48.3	.418 5918	200.72870	3.42498
15	9564.5	204 16 24.1	2 49 25.1	.423 3216	204.11515	3.34888
16	9565.5	207 34 07.7	2 26 57.0	.427 8464	207.42834	3.27842
17	9566.5	210 47 42.2	+2 04 28.1	0.432 1555	210.67379	3.21336
18	9567.5	213 57 27.9	1 42 02.3	.436 2393	213.85678	3.15347
19	9568.5	217 03 44.0	1 19 42.5	.440 0898	216.98238	3.09854
20	9569.5	220 06 48.8	0 57 31.6	.443 6997	220.05543	3.04833
21	9570.5	223 07 00.0	0 35 31.9	.447 0625	223.08055	3.00264
22	9571.5	226 04 34.3	+0 13 45.4	0.450 1724	226.06216	2.96129
23	9572.5	228 59 47.8	-0 07 46.1	.453 0247	229.00453	2.92413
24	9573.5	231 52 56.0	0 29 01.0	.455 6152	231.91175	2.89098
25	9574.5	234 44 13.8	0 49 57.8	.457 9401	234.78777	2.86169
26	9575.5	237 33 55.5	1 10 35.4	.459 9966	237.63639	2.83617
27	9576.5	240 22 14.9	-1 30 52.5	0.461 7815	240.46132	2.81428
28	9577.5	243 09 25.6	1 50 48.0	.463 2929	243.26614	2.79594
29	9578.5	245 55 40.6	2 10 20.8	.464 5288	246.05437	2.78109
30	9579.5	248 41 12.9	2 29 30.0	.465 4878	248.82946	2.76965
31	9580.5	251 26 14.9	2 48 14.5	.466 1689	251.59479	2.76156
Apr. 1	9581.5	254 10 59.2	-3 06 33.2	0.466 5713	254.35369	2.75680
2	9582.5	256 55 38.0	-3 24 25.0	0.466 6945	257.10949	2.75535

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
	243					
Apr. 1	9581.5	254 10 59.2	-3 06 33.2	0.466 5713	254.35369	2.75680
2	9582.5	256 55 38.0	3 24 25.0	.466 6945	257.10949	2.75535
3	9583.5	259 40 23.5	3 41 48.9	.466 5385	259.86548	2.75719
4	9584.5	262 25 27.9	3 58 43.5	.466 1030	262.62497	2.76234
5	9585.5	265 11 03.5	4 15 07.6	.465 3891	265.39127	2.77082
6	9586.5	267 57 22.5	-4 30 59.7	0.464 3974	268.16773	2.78267
7	9587.5	270 44 37.4	4 46 18.2	.463 1288	270.95775	2.79794
8	9588.5	273 33 00.9	5 01 01.5	.461 5850	273.76477	2.81668
9	9589.5	276 22 45.7	5 15 07.6	.459 7681	276.59230	2.83899
10	9590.5	279 14 04.9	5 28 34.4	.457 6799	279.44397	2.86496
11	9591.5	282 07 12.1	-5 41 19.7	0.455 3234	282.32347	2.89468
12	9592.5	285 02 21.1	5 53 21.0	.452 7017	285.23464	2.92832
13	9593.5	287 59 46.1	6 04 35.4	.449 8188	288.18144	2.96596
14	9594.5	290 59 41.9	6 14 59.8	.446 6788	291.16796	3.00781
15	9595.5	294 02 23.7	6 24 31.0	.443 2866	294.19851	3.05402
16	9596.5	297 08 07.5	-6 33 05.0	0.439 6480	297.27752	3.10478
17	9597.5	300 17 09.6	6 40 37.9	.435 7696	300.40966	3.16030
18	9598.5	303 29 47.1	6 47 05.1	.431 6586	303.59977	3.22077
19	9599.5	306 46 17.9	6 52 21.6	.427 3236	306.85293	3.28644
20	9600.5	310 07 00.4	6 56 22.2	.422 7741	310.17447	3.35756
21	9601.5	313 32 13.9	-6 59 01.0	0.418 0210	313.56994	3.43434
22	9602.5	317 02 18.2	7 00 11.7	.413 0764	317.04513	3.51705
23	9603.5	320 37 33.9	6 59 47.5	.407 9544	320.60610	3.60593
24	9604.5	324 18 22.4	6 57 41.1	.402 6700	324.25912	3.70119
25	9605.5	328 05 05.3	6 53 44.7	.397 2411	328.01068	3.80304
26	9606.5	331 58 04.9	-6 47 50.4	0.391 6873	331.86746	3.91166
27	9607.5	335 57 43.7	6 39 49.7	.386 0305	335.83628	4.02713
28	9608.5	340 04 24.2	6 29 33.9	.380 2952	339.92403	4.14952
29	9609.5	344 18 28.7	6 16 54.4	.374 5088	344.13759	4.27873
30	9610.5	348 40 18.7	6 01 42.9	.368 7015	348.48370	4.41457
May 1	9611.5	353 10 14.9	-5 43 51.5	0.362 9064	352.96883	4.55669
2	9612.5	357 48 36.0	5 23 13.2	.357 1599	357.59898	4.70450
3	9613.5	2 35 38.4	4 59 42.4	.351 5018	2.37945	4.85717
4	9614.5	7 31 35.6	4 33 15.4	.345 9750	7.31457	5.01359
5	9615.5	12 36 36.5	4 03 51.3	.340 6254	12.40739	5.17230
6	9616.5	17 50 45.2	-3 31 32.2	0.335 5014	17.65933	5.33149
7	9617.5	23 13 59.5	2 56 24.4	.330 6535	23.06981	5.48897
8	9618.5	28 46 09.8	2 18 38.9	.326 1338	28.63585	5.64216
9	9619.5	34 26 58.0	1 38 31.9	.321 9945	34.35173	5.78815
10	9620.5	40 15 56.6	0 56 25.7	.318 2869	40.20870	5.92378
11	9621.5	46 12 28.0	-0 12 47.9	0.315 0602	46.19473	6.04573
12	9622.5	52 15 43.8	+0 31 47.9	.312 3601	52.29451	6.15073
13	9623.5	58 24 45.1	1 16 43.4	.310 2259	58.48948	6.23563
14	9624.5	64 38 23.0	2 01 17.0	.308 6909	64.75818	6.29780
15	9625.5	70 55 19.7	2 44 44.9	.307 7790	71.07680	6.33517
16	9626.5	77 14 10.8	+3 26 23.5	0.307 5053	77.41981	6.34645
17	9627.5	83 33 26.8	+4 05 31.2	0.307 8742	83.76086	6.33126

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
²⁴³						
May	17	9627.5	83 33 26.8	+4 05 31.2	0.307 8742	83.76086 6.33126
	18	9628.5	89 51 36.8	4 41 31.0	.308 8796	90.07366 6.29010
	19	9629.5	96 07 10.9	5 13 51.4	.310 5052	96.33288 6.22441
	20	9630.5	102 18 43.4	5 42 08.5	.312 7255	102.51502 6.13634
	21	9631.5	108 24 55.1	6 06 06.1	.315 5065	108.59901 6.02863
	22	9632.5	114 24 36.3	+6 25 35.8	0.318 8074	114.56679 5.90444
	23	9633.5	120 16 47.2	6 40 36.9	.322 5821	120.40350 5.76707
	24	9634.5	126 00 40.0	6 51 15.1	.326 7812	126.09764 5.61982
	25	9635.5	131 35 37.9	6 57 41.6	.331 3530	131.64089 5.46581
	26	9636.5	137 01 15.9	7 00 11.6	.336 2450	137.02797 5.30793
	27	9637.5	142 17 18.9	+6 59 03.1	0.341 4057	142.25629 5.14867
	28	9638.5	147 23 41.4	6 54 36.0	.346 7845	147.32557 4.99018
	29	9639.5	152 20 25.9	6 47 10.7	.352 3336	152.23751 4.83425
	30	9640.5	157 07 41.4	6 37 07.5	.358 0075	156.99538 4.68224
	31	9641.5	161 45 42.4	6 24 46.3	.363 7637	161.60365 4.53521
June	1	9642.5	166 14 47.5	+6 10 25.6	0.369 5628	166.06775 4.39401
	2	9643.5	170 35 18.3	5 54 22.8	.375 3692	170.39378 4.25913
	3	9644.5	174 47 38.3	5 36 53.6	.381 1499	174.58824 4.13092
	4	9645.5	178 52 12.7	5 18 12.3	.386 8752	178.65790 4.00955
	5	9646.5	182 49 27.2	4 58 31.5	.392 5181	182.60965 3.89510
	6	9647.5	186 39 47.8	+4 38 02.8	0.398 0547	186.45039 3.78750
	7	9648.5	190 23 40.1	4 16 55.8	.403 4634	190.18690 3.68664
	8	9649.5	194 01 29.5	3 55 19.3	.408 7247	193.82585 3.59234
	9	9650.5	197 33 40.7	3 33 20.9	.413 8216	197.37369 3.50439
	10	9651.5	201 00 37.4	3 11 07.2	.418 7387	200.83668 3.42259
	11	9652.5	204 22 42.6	+2 48 43.7	0.423 4622	204.22082 3.34665
	12	9653.5	207 40 18.3	2 26 15.5	.427 9807	207.53186 3.27636
	13	9654.5	210 53 45.7	2 03 46.7	.432 2830	210.77534 3.21148
	14	9655.5	214 03 24.7	1 41 21.0	.436 3601	213.95653 3.15174
	15	9656.5	217 09 34.7	1 19 01.5	.440 2035	217.08047 3.09694
	16	9657.5	220 12 34.0	+0 56 50.9	0.443 8059	220.15199 3.04687
	17	9658.5	223 12 40.1	0 34 51.5	.447 1611	223.17572 3.00132
	18	9659.5	226 10 09.9	+0 13 05.4	.450 2634	226.15608 2.96010
	19	9660.5	229 05 19.4	-0 08 25.6	.453 1079	229.09732 2.92306
	20	9661.5	231 58 24.1	0 29 39.9	.455 6904	232.00354 2.89003
	21	9662.5	234 49 38.7	-0 50 36.2	0.458 0073	234.87866 2.86085
	22	9663.5	237 39 17.7	1 11 13.1	.460 0555	237.72650 2.83544
	23	9664.5	240 27 34.8	1 31 29.6	.461 8322	240.55076 2.81367
	24	9665.5	243 14 43.6	1 51 24.4	.463 3353	243.35502 2.79545
	25	9666.5	246 00 57.1	2 10 56.5	.464 5630	246.14281 2.78069
	26	9667.5	248 46 28.2	-2 30 05.0	0.465 5140	248.91754 2.76933
	27	9668.5	251 31 29.5	2 48 48.7	.466 1867	251.68260 2.76134
	28	9669.5	254 16 13.3	3 07 06.6	.466 5807	254.44134 2.75669
	29	9670.5	257 00 52.1	3 24 57.6	.466 6955	257.19708 2.75534
	30	9671.5	259 45 37.9	3 42 20.6	.466 5310	259.95311 2.75727
July	1	9672.5	262 30 43.0	-3 59 14.2	0.466 0872	262.71273 2.76252
	2	9673.5	265 16 19.6	-4 15 37.3	0.465 3650	265.47927 2.77111

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
July	243					
	1 9672.5	262 30 43.0	-3 59 14.2	0.466 0872	262.71273	2.76252
	2 9673.5	265 16 19.6	4 15 37.3	.465 3650	265.47927	2.77111
	3 9674.5	268 02 40.1	4 31 28.4	.464 3650	268.25607	2.78305
	4 9675.5	270 49 56.8	4 46 45.9	.463 0881	271.04652	2.79843
	5 9676.5	273 38 22.5	5 01 28.0	.461 5360	273.85408	2.81727
	6 9677.5	276 28 09.8	-5 15 32.9	0.459 7110	276.68225	2.83968
	7 9678.5	279 19 32.0	5 28 58.5	.457 6148	279.53467	2.86577
	8 9679.5	282 12 42.6	5 41 42.5	.455 2504	282.41504	2.89561
	9 9680.5	285 07 55.3	5 53 42.4	.452 6208	285.32719	2.92935
	10 9681.5	288 05 24.5	6 04 55.3	.449 7302	288.27509	2.96713
	11 9682.5	291 05 24.9	-6 15 18.1	0.446 5826	291.26285	3.00910
	12 9683.5	294 08 11.9	6 24 47.5	.443 1829	294.29475	3.05544
	13 9684.5	297 14 01.2	6 33 19.8	.439 5371	297.37525	3.10634
	14 9685.5	300 23 09.4	6 40 50.7	.435 6516	300.50901	3.16200
	15 9686.5	303 35 53.5	6 47 15.8	.431 5337	303.70090	3.22263
	16 9687.5	306 52 31.5	-6 52 30.1	0.427 1922	306.95600	3.28846
	17 9688.5	310 13 21.7	6 56 28.3	.422 6363	310.27964	3.35974
	18 9689.5	313 38 43.4	6 59 04.5	.417 8772	313.67738	3.43670
	19 9690.5	317 08 56.7	7 00 12.4	.412 9271	317.15502	3.51959
	20 9691.5	320 44 21.9	6 59 45.2	.407 7998	320.71862	3.60865
	21 9692.5	324 25 20.6	-6 57 35.6	0.402 5107	324.37446	3.70411
	22 9693.5	328 12 14.3	6 53 35.8	.397 0777	328.12904	3.80616
	23 9694.5	332 05 25.4	6 47 37.8	.391 5204	331.98904	3.91498
	24 9695.5	336 05 16.4	6 39 33.0	.385 8607	335.96129	4.03066
	25 9696.5	340 12 09.8	6 29 13.0	.380 1234	340.05267	4.15326
	26 9697.5	344 26 27.8	-6 16 29.1	0.374 3357	344.27008	4.28268
	27 9698.5	348 48 32.0	6 01 12.9	.368 5282	348.62024	4.41872
	28 9699.5	353 18 42.9	5 43 16.6	.362 7337	353.10961	4.56102
	29 9700.5	357 57 19.4	5 22 33.1	.356 9891	357.74417	4.70899
	30 9701.5	2 44 37.6	4 58 57.0	.351 3341	2.52920	4.86180
Aug.	31 9702.5	7 40 50.9	-4 32 24.7	0.345 8116	7.46900	5.01830
	1 9703.5	12 46 08.1	4 02 55.3	.340 4679	12.56656	5.17707
	2 9704.5	18 00 33.2	3 30 31.0	.335 3511	17.82328	5.33626
	3 9705.5	23 24 03.8	2 55 18.2	.330 5120	23.23849	5.49367
	4 9706.5	28 56 30.1	2 17 28.2	.326 0025	28.80916	5.64670
	5 9707.5	34 37 33.6	-1 37 17.3	0.321 8751	34.52946	5.79243
	6 9708.5	40 26 46.6	0 55 07.8	.318 1809	40.39054	5.92771
	7 9709.5	46 23 31.1	-0 11 27.8	.314 9691	46.38029	6.04922
	8 9710.5	52 26 58.4	+0 33 09.2	.312 2850	52.48328	6.15365
	9 9711.5	58 36 09.4	1 18 04.8	.310 1682	58.68087	6.23794
	10 9712.5	64 49 54.8	+2 02 37.1	0.308 6513	64.95154	6.29940
	11 9713.5	71 06 56.7	2 46 02.4	.307 7581	71.27137	6.33600
	12 9714.5	77 25 50.2	3 27 37.0	.307 5035	77.61483	6.34650
	13 9715.5	83 45 06.0	4 06 39.6	.307 8914	83.95554	6.33052
	14 9716.5	90 03 13.1	4 42 33.2	.308 9156	90.26722	6.28861
	15 9717.5	96 18 41.7	+5 14 46.6	0.310 5595	96.52459	6.22222
	16 9718.5	102 30 06.1	+5 42 56.1	0.312 7972	102.70421	6.13352

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
 MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
	243					
Aug. 16	9718.5	102° 30' 06".1	+5° 42' 56".1	0.312 7972	102.70421	6.13352
17	9719.5	108 36 07.6	6 06 45.6	.315 5943	108.78510	6.02526
18	9720.5	114 35 36.5	6 26 07.2	.318 9103	114.74927	5.90062
19	9721.5	120 27 33.6	6 41 00.2	.322 6985	120.58198	5.76290
20	9722.5	126 11 11.2	6 51 30.6	.326 9096	126.27180	5.61538
21	9723.5	131 45 53.1	+6 57 49.6	0.331 4920	131.81053	5.46122
22	9724.5	137 11 14.3	7 00 12.7	.336 3930	137.19297	5.30325
23	9725.5	142 27 00.2	6 58 57.8	.341 5610	142.41660	5.14397
24	9726.5	147 33 05.6	6 54 24.9	.346 9459	147.48120	4.98554
25	9727.5	152 29 33.1	6 46 54.4	.352 4997	152.38854	4.82969
26	9728.5	157 16 32.0	+6 36 46.7	0.358 1768.	157.14190	4.67779
27	9729.5	161 54 16.8	6 24 21.6	.363 9351	161.74581	4.53094
28	9730.5	166 23 06.2	6 09 57.5	.369 7352	166.20572	4.38990
29	9731.5	170 43 22.0	5 53 51.7	.375 5414	170.52773	4.25521
30	9732.5	174 55 27.8	5 36 20.0	.381 3212	174.71837	4.12720
31	9733.5	178 59 48.7	+5 17 36.7	0.387 0446	178.78441	4.00604
Sept. 1	9734.5	182 56 50.4	4 57 54.3	.392 6849	182.73275	3.89178
2	9735.5	186 46 58.9	4 37 24.1	.398 2181	186.57026	3.78438
3	9736.5	190 30 40.0	4 16 16.1	.403 6228	190.30376	3.68372
4	9737.5	194 08 18.9	3 54 38.8	.408 8796	193.93988	3.58961
5	9738.5	197 40 20.3	+3 32 39.8	0.413 9716	197.48509	3.50184
6	9739.5	201 07 07.8	3 10 25.7	.418 8831	200.94561	3.42020
7	9740.5	204 29 04.6	2 48 02.0	.423 6008	204.32746	3.34445
8	9741.5	207 46 32.5	2 25 33.6	.428 1129	207.63638	3.27432
9	9742.5	210 59 52.6	2 03 04.9	.432 4088	210.87790	3.20959
10	9743.5	214 09 25.1	+1 40 39.3	0.436 4790	214.05727	3.15001
11	9744.5	217 15 29.0	1 18 20.0	.440 3154	217.17956	3.09536
12	9745.5	220 18 22.8	0 56 09.7	.443 9107	220.24956	3.04542
13	9746.5	223 18 23.9	0 34 10.7	.447 2584	223.27191	3.00001
14	9747.5	226 15 49.2	+0 12 25.0	.450 3529	226.25102	2.95891
15	9748.5	229 10 54.7	-0 09 05.5	0.453 1897	229.19113	2.92199
16	9749.5	232 03 55.8	0 30 19.3	.455 7643	232.09634	2.88908
17	9750.5	234 55 07.3	0 51 15.0	.458 0730	234.97057	2.86002
18	9751.5	237 44 43.5	1 11 51.3	.460 1130	237.81763	2.83472
19	9752.5	240 32 58.3	1 32 07.1	.461 8813	240.64122	2.81306
20	9753.5	243 20 05.2	-1 52 01.2	0.463 3762	243.44492	2.79493
21	9754.5	246 06 17.2	2 11 32.7	.464 5955	246.23224	2.78028
22	9755.5	248 51 47.2	2 30 40.4	.465 5381	249.00662	2.76904
23	9756.5	251 36 47.7	2 49 23.3	.466 2023	251.77144	2.76115
24	9757.5	254 21 31.2	3 07 40.3	.466 5878	254.53003	2.75659
25	9758.5	257 06 10.0	-3 25 30.5	0.466 6941	257.28572	2.75533
26	9759.5	259 50 56.2	3 42 52.6	.466 5211	260.04180	2.75739
27	9760.5	262 36 02.1	3 59 45.3	.466 0688	262.80159	2.76274
28	9761.5	265 21 39.9	4 16 07.4	.465 3379	265.56838	2.77141
29	9762.5	268 08 01.8	4 31 57.5	.464 3293	268.34554	2.78347
30	9763.5	270 55 20.5	-4 47 13.9	0.463 0439	271.13646	2.79894
Oct. 1	9764.5	273 43 48.4	-5 01 54.9	0.461 4835	273.94459	2.81791

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
	243	° ' "	° ' "		°	°
Oct. 1	9764.5	273 43 48.4	-5 01 54.9	0.461 4835	273.94459	2.81791
2	9765.5	276 33 38.4	5 15 58.6	.459 6499	276.77346	2.84043
3	9766.5	279 25 03.8	5 29 22.9	.457 5454	279.62668	2.86663
4	9767.5	282 18 17.9	5 42 05.6	.455 1728	282.50797	2.89659
5	9768.5	285 13 34.6	5 54 04.0	.452 5352	285.42116	2.93045
6	9769.5	288 11 08.2	-6 05 15.4	0.449 6364	288.37022	2.96835
7	9770.5	291 11 13.6	6 15 36.7	.446 4808	291.35927	3.01046
8	9771.5	294 14 05.9	6 25 04.4	.443 0736	294.39260	3.05695
9	9772.5	297 20 01.1	6 33 34.8	.439 4202	297.47468	3.10799
10	9773.5	300 29 15.7	6 41 03.7	.435 5273	300.61016	3.16379
11	9774.5	303 42 06.8	-6 47 26.7	0.431 4024	303.80393	3.22459
12	9775.5	306 58 52.3	6 52 38.7	.427 0539	307.06107	3.29058
13	9776.5	310 19 50.6	6 56 34.5	.422 4916	310.38691	3.36204
14	9777.5	313 45 21.1	6 59 08.0	.417 7264	313.78704	3.43918
15	9778.5	317 15 43.6	7 00 13.1	.412 7704	317.26725	3.52225
16	9779.5	320 51 18.9	-6 59 42.8	0.407 6377	320.83361	3.61151
17	9780.5	324 32 28.2	6 57 29.8	.402 3438	324.49241	3.70718
18	9781.5	328 19 33.4	6 53 26.5	.396 9066	328.25017	3.80944
19	9782.5	332 12 56.6	6 47 24.7	.391 3456	332.11355	3.91847
20	9783.5	336 13 00.3	6 39 15.9	.385 6831	336.08940	4.03437
21	9784.5	340 20 07.2	-6 28 51.5	0.379 9437	340.18460	4.15719
22	9785.5	344 34 39.4	6 16 03.0	.374 1548	344.40605	4.28682
23	9786.5	348 56 58.5	6 00 41.9	.368 3470	348.76045	4.42306
24	9787.5	353 27 24.9	5 42 40.5	.362 5534	353.25426	4.56555
25	9788.5	358 06 17.4	5 21 51.7	.356 8108	357.89343	4.71368
26	9789.5	2 53 52.2	-4 58 10.2	0.351 1592	2.68323	4.86663
27	9790.5	7 50 22.3	4 31 32.4	.345 6417	7.62792	5.02325
28	9791.5	12 55 56.7	4 01 57.4	.340 3041	12.73046	5.18206
29	9792.5	18 10 39.0	3 29 27.8	.335 1951	17.99216	5.34123
30	9793.5	23 34 26.5	2 54 09.9	.330 3652	23.41230	5.49854
31	9794.5	29 07 09.3	-2 16 15.2	0.325 8667	28.98775	5.65139
Nov. 1	9795.5	34 48 28.7	1 36 00.2	.321 7521	34.71262	5.79686
2	9796.5	40 37 56.5	0 53 47.5	.318 0723	40.57794	5.93176
3	9797.5	46 34 54.5	-0 10 05.1	.314 8762	46.57151	6.05280
4	9798.5	52 38 33.6	+0 34 33.1	.312 2091	52.67780	6.15665
5	9799.5	58 47 54.4	+1 19 28.6	0.310 1104	58.87805	6.24025
6	9800.5	65 01 47.3	2 03 59.5	.308 6127	65.15066	6.30097
7	9801.5	71 18 54.1	2 47 22.0	.307 7393	71.47167	6.33677
8	9802.5	77 37 49.8	3 28 52.5	.307 5048	77.81549	6.34645
9	9803.5	83 57 05.1	4 07 49.8	.307 9128	84.15574	6.32964
10	9804.5	90 15 08.7	+4 43 37.0	0.308 9565	90.46614	6.28695
11	9805.5	96 30 31.1	5 15 43.1	.310 6194	96.72148	6.21982
12	9806.5	102 41 46.7	5 43 44.7	.312 8751	102.89836	6.13045
13	9807.5	108 47 37.2	6 07 25.9	.315 6893	108.97590	6.02163
14	9808.5	114 46 52.9	6 26 39.1	.319 0208	114.93620	5.89653
15	9809.5	120 38 35.2	+6 41 23.8	0.322 8229	120.76464	5.75845
16	9810.5	126 21 56.6	+6 51 46.2	0.327 0464	126.44987	5.61068

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
 MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
Nov.	16	243 9810.5	126° 21' 56".6	+6° 51' 46".2	0.327 0464	126.44987 5.61068
	17	9811.5	131 56 21.4	6 57 57.6	.331 6396	131.98381 5.45635
	18	9812.5	137 21 24.8	7 00 13.5	.336 5498	137.36133 5.29829
	19	9813.5	142 36 52.7	6 58 52.2	.341 7254	142.57999 5.13901
	20	9814.5	147 42 40.0	6 54 13.4	.347 1165	147.63966 4.98063
	21	9815.5	152 38 49.6	+6 46 37.7	0.352 6748	152.54213 4.82488
	22	9816.5	157 25 30.9	6 36 25.5	.358 3552	157.29075 4.67313
	23	9817.5	162 02 58.7	6 23 56.3	.364 1154	161.89008 4.52645
	24	9818.5	166 31 31.8	6 09 28.8	.369 9163	166.34559 4.38559
	25	9819.5	170 51 31.8	5 53 20.1	.375 7222	170.66339 4.25111
	26	9820.5	175 03 22.7	+5 35 46.0	0.381 5007	174.85003 4.12330
	27	9821.5	179 07 29.5	5 17 00.6	.387 2220	178.91228 4.00236
	28	9822.5	183 04 17.9	4 57 16.5	.392 8594	182.85705 3.88832
	29	9823.5	186 54 13.9	4 36 45.1	.398 3890	186.69121 3.78113
	30	9824.5	190 37 43.3	4 15 36.0	.403 7893	190.42156 3.68067
Dec.	1	9825.5	194 15 11.3	+3 53 57.9	0.409 0411	194.05474 3.58676
	2	9826.5	197 47 02.4	3 31 58.4	.414 1276	197.59720 3.49920
	3	9827.5	201 13 40.6	3 09 43.9	.419 0334	201.05518 3.41775
	4	9828.5	204 35 28.6	2 47 20.0	.423 7450	204.43466 3.34217
	5	9829.5	207 52 48.5	2 24 51.6	.428 2506	207.74139 3.27221
	6	9830.5	211 06 01.1	+2 02 22.8	0.432 5396	210.98088 3.20764
	7	9831.5	214 15 26.7	1 39 57.4	.436 6026	214.15839 3.14821
	8	9832.5	217 21 24.4	1 17 38.3	.440 4314	217.27895 3.09372
	9	9833.5	220 24 12.6	0 55 28.3	.444 0189	220.34740 3.04393
	10	9834.5	223 24 08.6	0 33 29.7	.447 3587	223.36832 2.99865
	11	9835.5	226 21 29.2	+0 11 44.6	0.450 4453	226.34615 2.95770
	12	9836.5	229 16 30.6	-0 09 45.5	.453 2739	229.28511 2.92090
	13	9837.5	232 09 28.0	0 30 58.7	.455 8404	232.18928 2.88811
	14	9838.5	235 00 36.3	0 51 53.9	.458 1407	235.06261 2.85918
	15	9839.5	237 50 09.8	1 12 29.6	.460 1723	237.90888 2.83399
	16	9840.5	240 38 22.3	-1 32 44.7	0.461 9322	240.73180 2.81243
	17	9841.5	243 25 27.2	1 52 38.1	.463 4184	243.53493 2.79442
	18	9842.5	246 11 37.8	2 12 08.8	.464 6291	246.32180 2.77988
	19	9843.5	248 57 06.6	2 31 15.8	.465 5627	249.09583 2.76874
	20	9844.5	251 42 06.4	2 49 57.9	.466 2183	251.86040 2.76097
	21	9845.5	254 26 49.6	-3 08 14.1	0.466 5950	254.61887 2.75651
	22	9846.5	257 11 28.5	3 26 03.4	.466 6925	257.37452 2.75535
	23	9847.5	259 56 15.1	3 43 24.6	.466 5108	260.13068 2.75750
	24	9848.5	262 41 21.9	4 00 16.4	.466 0499	262.89063 2.76296
	25	9849.5	265 27 00.9	4 16 37.6	.465 3102	265.65771 2.77175
	26	9850.5	268 13 24.5	-4 32 26.6	0.464 2930	268.43526 2.78391
	27	9851.5	271 00 45.1	4 47 41.9	.462 9988	271.22668 2.79950
	28	9852.5	273 49 15.4	5 02 21.8	.461 4298	274.03542 2.81856
	29	9853.5	276 39 08.3	5 16 24.3	.459 5877	276.86500 2.84121
	30	9854.5	279 30 36.8	5 29 47.4	.457 4747	279.71905 2.86750
	31	9855.5	282 23 54.6	-5 42 28.7	0.455 0937	282.60127 2.89759
	32	9856.5	285 19 15.4	-5 54 25.7	0.452 4478	285.51553 2.93159

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
 MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion	Orb. Lat.
	243						
Jan. 0	9490.5	308° 36' 57.9	-2° 41' 03.6	0.728 2377	308.66479	1.58062	+0.35
2	9492.5	311 46 44.4	2 47 41.3	.728 2406	311.82601	.58061	.34
4	9494.5	314 56 33.1	2 53 48.5	.728 2283	314.98727	.58066	.33
6	9496.5	318 06 24.3	2 59 23.9	.728 2010	318.14871	.58078	.32
8	9498.5	321 16 18.5	3 04 26.6	.728 1586	321.31044	.58096	.31
10	9500.5	324 26 15.9	-3 08 55.6	0.728 1014	324.47261	1.58121	+0.30
12	9502.5	327 36 16.9	3 12 50.2	.728 0294	327.63534	.58153	.29
14	9504.5	330 46 21.7	3 16 09.5	.727 9429	330.79876	.58190	.28
16	9506.5	333 56 30.6	3 18 52.9	.727 8422	333.96299	.58234	.27
18	9508.5	337 06 43.8	3 21 00.0	.727 7276	337.12816	.58284	.26
20	9510.5	340 17 01.5	-3 22 30.2	0.727 5994	340.29438	1.58339	+0.24
22	9512.5	343 27 23.9	3 23 23.4	.727 4579	343.46177	.58401	.22
24	9514.5	346 37 51.2	3 23 39.2	.727 3037	346.63045	.58468	.21
26	9516.5	349 48 23.5	3 23 17.6	.727 1371	349.80053	.58541	.19
28	9518.5	352 59 00.9	3 22 18.5	.726 9587	352.97211	.58618	.17
30	9520.5	356 09 43.6	-3 20 42.2	0.726 7691	356.14530	1.58701	+0.15
Feb. 1	9522.5	359 20 31.8	3 18 28.9	.726 5687	359.32019	.58789	.13
3	9524.5	2 31 25.4	3 15 38.8	.726 3583	2.49688	.58881	.11
5	9526.5	5 42 24.6	3 12 12.5	.726 1384	5.67545	.58977	.08
7	9528.5	8 53 29.6	3 08 10.6	.725 9097	8.85599	.59077	.06
9	9530.5	12 04 40.3	-3 03 33.6	0.725 6729	12.03857	1.59181	+0.03
11	9532.5	15 15 56.8	2 58 22.5	.725 4287	15.22325	.59288	+ .01
13	9534.5	18 27 19.3	2 52 38.1	.725 1779	18.41011	.59398	- .01
15	9536.5	21 38 47.8	2 46 21.3	.724 9213	21.59920	.59511	.03
17	9538.5	24 50 22.4	2 39 33.4	.724 6596	24.79057	.59626	.05
19	9540.5	28 02 03.2	-2 32 15.4	0.724 3936	27.98426	1.59743	-0.07
21	9542.5	31 13 50.2	2 24 28.7	.724 1243	31.18031	.59862	.09
23	9544.5	34 25 43.6	2 16 14.8	.723 8523	34.37876	.59982	.11
25	9546.5	37 37 43.4	2 07 34.9	.723 5785	37.57961	.60103	.14
27	9548.5	40 49 49.8	1 58 30.9	.723 3039	40.78289	.60225	.16
Mar. 1	9550.5	44 02 02.8	-1 49 04.2	0.723 0293	43.98861	1.60347	-0.18
3	9552.5	47 14 22.5	1 39 16.6	.722 7554	47.19677	.60468	.20
5	9554.5	50 26 49.0	1 29 10.0	.722 4833	50.40734	.60589	.23
7	9556.5	53 39 22.3	1 18 46.1	.722 2137	53.62033	.60709	.25
9	9558.5	56 52 02.6	1 08 06.9	.721 9474	56.83570	.60828	.27
11	9560.5	60 04 50.0	-0 57 14.4	0.721 6854	60.05343	1.60945	-0.29
13	9562.5	63 17 44.4	0 46 10.6	.721 4285	63.27347	.61059	.30
15	9564.5	66 30 46.0	0 34 57.7	.721 1774	66.49578	.61171	.32
17	9566.5	69 43 54.8	0 23 37.6	.720 9330	69.72030	.61281	.34
19	9568.5	72 57 10.8	0 12 12.6	.720 6960	72.94699	.61387	.36
21	9570.5	76 10 34.0	-0 00 44.9	0.720 4672	76.17575	1.61489	-0.37
23	9572.5	79 24 04.5	+0 10 43.4	.720 2474	79.40653	.61588	.39
25	9574.5	82 37 42.1	0 22 10.1	.720 0373	82.63924	.61682	.41
27	9576.5	85 51 26.8	0 33 32.9	.719 8375	85.87379	.61772	.41
29	9578.5	89 05 18.6	0 44 49.7	.719 6486	89.11009	.61857	.42
31	9580.5	92 19 17.2	+0 55 58.3	0.719 4714	92.34803	1.61937	-0.43
Apr. 2	9582.5	95 33 22.7	+1 06 56.6	0.719 3063	95.58752	1.62011	-0.44

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
 MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion	Orb. Lat.	
Apr.	2	243 9582.5	° 33' 22.7"	+1 06' 56.6"	0.719 3063	95.58752	1.62011	-0.44
	4	9584.5	98 47 34.7	1 17 42.3	0.719 1538	98.82844	0.62080	.44
	6	9586.5	102 01 53.1	1 28 13.4	0.719 0146	102.07068	0.62143	.45
	8	9588.5	105 16 17.5	1 38 27.8	0.718 8890	105.31411	0.62199	.45
	10	9590.5	108 30 47.8	1 48 23.5	0.718 7774	108.55861	0.62250	.45
	12	9592.5	111 45 23.6	+1 57 58.6	0.718 6802	111.80405	1.62294	-0.45
	14	9594.5	115 00 04.5	2 07 11.2	0.718 5978	115.05031	0.62331	.45
	16	9596.5	118 14 50.0	2 15 59.4	0.718 5303	118.29724	0.62361	.45
	18	9598.5	121 29 39.9	2 24 21.5	0.718 4781	121.54471	0.62385	.45
	20	9600.5	124 44 33.5	2 32 15.9	0.718 4413	124.79259	0.62402	.44
	22	9602.5	127 59 30.4	+2 39 41.1	0.718 4200	128.04073	1.62411	-0.43
	24	9604.5	131 14 30.0	2 46 35.5	0.718 4142	131.28900	0.62414	.42
	26	9606.5	134 29 31.7	2 52 57.7	0.718 4241	134.53724	0.62409	.41
	28	9608.5	137 44 34.9	2 58 46.7	0.718 4494	137.78532	0.62398	.40
	30	9610.5	140 59 39.0	3 04 01.1	0.718 4903	141.03311	0.62379	.39
May	2	9612.5	144 14 43.3	+3 08 40.0	0.718 5465	144.28045	1.62354	-0.38
	4	9614.5	147 29 47.1	3 12 42.5	0.718 6179	147.52722	0.62322	.36
	6	9616.5	150 44 49.8	3 16 07.8	0.718 7042	150.77327	0.62283	.34
	8	9618.5	153 59 50.7	3 18 55.3	0.718 8052	154.01848	0.62237	.32
	10	9620.5	157 14 49.0	3 21 04.4	0.718 9205	157.26271	0.62185	.30
	12	9622.5	160 29 44.1	+3 22 34.9	0.719 0497	160.50584	1.62127	-0.28
	14	9624.5	163 44 35.2	3 23 26.3	0.719 1924	163.74774	0.62062	.25
	16	9626.5	166 59 21.7	3 23 38.6	0.719 3481	166.98830	0.61993	.23
	18	9628.5	170 14 02.9	3 23 11.8	0.719 5165	170.22740	0.61916	.20
	20	9630.5	173 28 38.0	3 22 06.1	0.719 6968	173.46492	0.61835	.18
	22	9632.5	176 43 06.6	+3 20 21.7	0.719 8885	176.70077	1.61749	-0.15
	24	9634.5	179 57 28.0	3 17 59.0	0.720 0910	179.93484	0.61658	.12
	26	9636.5	183 11 41.6	3 14 58.5	0.720 3037	183.16706	0.61563	.09
	28	9638.5	186 25 46.9	3 11 20.9	0.720 5258	186.39732	0.61463	.06
	30	9640.5	189 39 43.4	3 07 07.0	0.720 7567	189.62555	0.61360	-0.03
June	1	9642.5	192 53 30.6	+3 02 17.7	0.720 9955	192.85168	1.61253	0.00
	3	9644.5	196 07 08.2	2 56 53.9	0.721 2417	196.07563	0.61142	+0.03
	5	9646.5	199 20 35.8	2 50 56.8	0.721 4942	199.29736	0.61030	.05
	7	9648.5	202 33 53.0	2 44 27.5	0.721 7525	202.51681	0.60915	.08
	9	9650.5	205 46 59.7	2 37 27.5	0.722 0155	205.73393	0.60797	.11
	11	9652.5	208 59 55.7	+2 29 58.0	0.722 2826	208.94869	1.60679	+0.14
	13	9654.5	212 12 40.8	2 22 00.6	0.722 5528	212.16106	0.60558	.16
	15	9656.5	215 25 14.9	2 13 36.8	0.722 8253	215.37101	0.60437	.19
	17	9658.5	218 37 38.1	2 04 48.3	0.723 0993	218.57854	0.60316	.22
	19	9660.5	221 49 50.3	1 55 36.8	0.723 3739	221.78364	0.60194	.25
	21	9662.5	225 01 51.7	+1 46 04.2	0.723 6482	224.98630	1.60072	+0.27
	23	9664.5	228 13 42.3	1 36 12.1	0.723 9214	228.18654	0.59952	.30
	25	9666.5	231 25 22.4	1 26 02.6	0.724 1927	231.38438	0.59832	.33
	27	9668.5	234 36 52.2	1 15 37.4	0.724 4611	234.57983	0.59714	.36
	29	9670.5	237 48 12.1	1 04 58.7	0.724 7259	237.77294	0.59597	.38
July	1	9672.5	240 59 22.2	+0 54 08.4	0.724 9862	240.96373	1.59482	+0.40
	3	9674.5	244 10 23.1	+0 43 08.6	0.725 2412	244.15225	1.59370	+0.43

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion	Orb. Lat.	
	243							
July	1	9672.5	240° 59' 22.2	+0° 54' 08.4	0.724 9862	240.96373	1.59482	+0.40
	3	9674.5	244 10 23.1	0 43 08.6	.725 2412	244.15225	.59370	.43
	5	9676.5	247 21 15.0	0 32 01.2	.725 4902	247.33856	.59261	.45
	7	9678.5	250 31 58.6	0 20 48.3	.725 7324	250.52271	.59155	.47
	9	9680.5	253 42 34.1	+0 09 32.1	.725 9671	253.70478	.59052	.49
	11	9682.5	256 53 02.2	-0 01 45.5	0.726 1935	256.88482	1.58953	+0.50
	13	9684.5	260 03 23.4	0 13 02.4	.726 4109	260.06292	.58858	.52
	15	9686.5	263 13 38.1	0 24 16.4	.726 6187	263.23916	.58767	.54
	17	9688.5	266 23 47.0	0 35 25.6	.726 8163	266.41363	.58681	.56
	19	9690.5	269 33 50.7	0 46 28.0	.727 0031	269.58643	.58599	.58
	21	9692.5	272 43 49.6	-0 57 21.5	0.727 1784	272.75764	1.58523	+0.59
	23	9694.5	275 53 44.5	1 08 04.2	.727 3418	275.92738	.58452	.59
	25	9696.5	279 03 35.8	1 18 34.2	.727 4928	279.09575	.58386	.60
	27	9698.5	282 13 24.2	1 28 49.6	.727 6310	282.26286	.58326	.61
	29	9700.5	285 23 10.2	1 38 48.5	.727 7558	285.42883	.58272	.62
	Aug.	31	9702.5	288 32 54.3	-1 48 29.2	0.727 8670	288.59378	1.58223	+0.62
2		9704.5	291 42 37.2	1 57 49.9	.727 9642	291.75781	.58181	.62
4		9706.5	294 52 19.4	2 06 49.0	.728 0471	294.92107	.58146	.63
6		9708.5	298 02 01.4	2 15 24.8	.728 1155	298.08368	.58116	.63
8		9710.5	301 11 43.6	2 23 35.8	.728 1692	301.24575	.58093	.63
10		9712.5	304 21 26.7	-2 31 20.6	0.728 2079	304.40743	1.58076	+0.63
12		9714.5	307 31 10.9	2 38 37.7	.728 2318	307.56883	.58065	.62
14		9716.5	310 40 56.8	2 45 25.9	.728 2405	310.73009	.58062	.62
16		9718.5	313 50 44.7	2 51 43.8	.728 2342	313.89135	.58065	.62
18		9720.5	317 00 35.1	2 57 30.4	.728 2129	317.05273	.58074	.62
20		9722.5	320 10 28.2	-3 02 44.6	0.728 1765	320.21435	1.58090	+0.61
22		9724.5	323 20 24.5	3 07 25.5	.728 1253	323.37636	.58112	.61
24		9726.5	326 30 24.2	3 11 32.1	.728 0594	326.53888	.58141	.61
26		9728.5	329 40 27.7	3 15 03.8	.727 9790	329.70204	.58176	.60
28		9730.5	332 50 35.1	3 17 59.8	.727 8842	332.86596	.58217	.60
Sept.		30	9732.5	336 00 46.7	-3 20 19.6	0.727 7755	336.03076	1.58264	+0.59
	1	9734.5	339 11 02.7	3 22 02.7	.727 6532	339.19657	.58318	.59
	3	9736.5	342 21 23.2	3 23 08.8	.727 5175	342.36351	.58377	.59
	5	9738.5	345 31 48.6	3 23 37.6	.727 3690	345.53167	.58441	.58
	7	9740.5	348 42 18.9	3 23 29.0	.727 2080	348.70118	.58511	.58
	9	9742.5	351 52 54.2	-3 22 43.0	0.727 0351	351.87215	1.58587	+0.58
	11	9744.5	355 03 34.8	3 21 19.6	.726 8507	355.04468	.58667	.58
	13	9746.5	358 14 20.6	3 19 19.1	.726 6555	358.21886	.58752	.57
	15	9748.5	1 25 11.9	3 16 41.8	.726 4499	1.39479	.58842	.57
	17	9750.5	4 36 08.7	3 13 28.1	.726 2347	4.57256	.58936	.57
	19	9752.5	7 47 11.1	-3 09 38.5	0.726 0105	7.75226	1.59034	+0.57
	21	9754.5	10 58 19.1	3 05 13.6	.725 7780	10.93395	.59136	.56
	23	9756.5	14 09 33.0	3 00 14.3	.725 5378	14.11771	.59241	.56
	25	9758.5	17 20 52.7	2 54 41.4	.725 2907	17.30362	.59350	.56
	27	9760.5	20 32 18.4	2 48 35.8	.725 0374	20.49172	.59461	.56
	Oct.	29	9762.5	23 43 50.1	-2 41 58.6	0.724 7788	23.68207	1.59575	+0.55
1		9764.5	26 55 27.8	-2 34 51.0	0.724 5155	26.87472	1.59690	+0.55

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
 MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion	Orb. Lat.
	243						
Oct. 1	9764.5	26° 55' 27.8	-2° 34' 51.0	0.724 5155	26.87472	1.59690	+0.55
3	9766.5	30 07 11.8	2 27 14.2	.724 2486	30.06970	.59808	.54
5	9768.5	33 19 02.1	2 19 09.7	.723 9786	33.26705	.59927	.53
7	9770.5	36 30 58.7	2 10 38.7	.723 7065	36.46679	.60047	.52
9	9772.5	39 43 01.7	2 01 43.0	.723 4332	39.66894	.60168	.51
11	9774.5	42 55 11.3	-1 52 24.0	0.723 1594	42.87352	1.60290	+0.50
13	9776.5	46 07 27.6	1 42 43.6	.722 8861	46.08052	.60411	.49
15	9778.5	49 19 50.6	1 32 43.5	.722 6140	49.28994	.60531	.48
17	9780.5	52 32 20.4	1 22 25.4	.722 3441	52.50177	.60651	.47
19	9782.5	55 44 57.1	1 11 51.4	.722 0771	55.71599	.60770	.45
21	9784.5	58 57 40.8	-1 01 03.4	0.721 8140	58.93257	1.60887	+0.43
23	9786.5	62 10 31.6	0 50 03.4	.721 5555	62.15147	.61003	.42
25	9788.5	65 23 29.4	0 38 53.5	.721 3024	65.37266	.61116	.40
27	9790.5	68 36 34.5	0 27 35.8	.721 0557	68.59608	.61226	.38
29	9792.5	71 49 46.7	0 16 12.4	.720 8160	71.82167	.61333	.35
31	9794.5	75 03 06.2	-0 04 45.4	0.720 5841	75.04938	1.61437	+0.32
Nov. 2	9796.5	78 16 32.9	+0 06 42.8	.720 3607	78.27912	.61537	.29
4	9798.5	81 30 06.8	0 18 10.2	.720 1467	81.51083	.61633	.27
6	9800.5	84 43 47.9	0 29 34.6	.719 9426	84.74441	.61725	.24
8	9802.5	87 57 36.0	0 40 53.7	.719 7491	87.97978	.61812	.21
10	9804.5	91 11 31.1	+0 52 05.4	0.719 5669	91.21684	1.61894	+0.18
12	9806.5	94 25 33.1	1 03 07.4	.719 3965	94.45549	.61970	.15
14	9808.5	97 39 41.7	1 13 57.6	.719 2385	97.69562	.62042	.12
16	9810.5	100 53 56.8	1 24 34.0	.719 0934	100.93712	.62107	.09
18	9812.5	104 08 18.2	1 34 54.4	.718 9617	104.17986	.62166	.06
20	9814.5	107 22 45.5	+1 44 56.9	0.718 8437	107.42373	1.62220	+0.03
22	9816.5	110 37 18.5	1 54 39.4	.718 7399	110.66861	.62267	.00
24	9818.5	113 51 56.8	2 04 00.0	.718 6506	113.91435	.62307	-.03
26	9820.5	117 06 39.9	2 12 56.9	.718 5762	117.16083	.62340	.06
28	9822.5	120 21 27.6	2 21 28.4	.718 5168	120.40792	.62367	.08
30	9824.5	123 36 19.2	+2 29 32.7	0.718 4727	123.65548	1.62387	-0.11
Dec. 2	9826.5	126 51 14.4	2 37 08.2	.718 4439	126.90336	.62400	.14
4	9828.5	130 06 12.5	2 44 13.5	.718 4307	130.15144	.62406	.17
6	9830.5	133 21 13.0	2 50 47.2	.718 4329	133.39957	.62405	.19
8	9832.5	136 36 15.3	2 56 47.9	.718 4507	136.64761	.62397	.22
10	9834.5	139 51 18.8	+3 02 14.6	0.718 4840	139.89541	1.62382	-0.25
12	9836.5	143 06 22.9	3 07 06.0	.718 5326	143.14285	.62360	.28
14	9838.5	146 21 26.7	3 11 21.4	.718 5964	146.38978	.62331	.30
16	9840.5	149 36 29.8	3 14 59.9	.718 6752	149.63606	.62296	.32
18	9842.5	152 51 31.3	3 18 00.7	.718 7688	152.88157	.62254	.35
20	9844.5	156 06 30.6	+3 20 23.3	0.718 8768	156.12616	1.62205	-0.37
22	9846.5	159 21 27.0	3 22 07.4	.718 9988	159.36972	.62150	.39
24	9848.5	162 36 19.8	3 23 12.5	.719 1346	162.61211	.62088	.40
26	9850.5	165 51 08.2	3 23 38.6	.719 2836	165.85321	.62021	.42
28	9852.5	169 05 51.6	3 23 25.5	.719 4454	169.09292	.61948	.43
30	9854.5	172 20 29.3	+3 22 33.4	0.719 6194	172.33111	1.61870	-0.44
32	9856.5	175 35 00.7	+3 21 02.5	0.719 8051	175.56769	1.61787	-0.45

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion	Orb. Lat.
	243						
Jan. -2	9488.5	156° 43' 59.0	+1° 45' 53.6	1.665 967	156.72452	0.436 472	-0.46
2	9492.5	158 28 47.5	1 44 49.8	.665 773	158.47058	.436 574	.46
6	9496.5	160 13 37.9	1 43 40.2	.665 420	160.21722	.436 759	.45
10	9500.5	161 58 31.4	1 42 24.8	.664 908	161.96476	.437 025	.45
14	9504.5	163 43 29.2	1 41 03.7	.664 237	163.71353	.437 376	.45
18	9508.5	165 28 32.5	+1 39 36.8	1.663 409	165.46388	0.437 811	-0.45
22	9512.5	167 13 42.6	1 38 04.2	.662 423	167.21613	.438 330	.45
26	9516.5	168 59 00.5	1 36 25.9	.661 280	168.97063	.438 932	.46
30	9520.5	170 44 27.6	1 34 42.1	.659 982	170.72770	.439 618	.46
Feb. 3	9524.5	172 30 05.0	1 32 52.8	.658 528	172.48769	.440 390	.46
7	9528.5	174 15 53.9	+1 30 58.0	1.656 921	174.25093	0.441 244	-0.46
11	9532.5	176 01 55.4	1 28 57.7	.655 162	176.01775	.442 181	.46
15	9536.5	177 48 10.9	1 26 52.2	.653 251	177.78849	.443 202	.46
19	9540.5	179 34 41.6	1 24 41.3	.651 190	179.56348	.444 307	.46
23	9544.5	181 21 28.5	1 22 25.2	.648 981	181.34306	.445 498	.46
27	9548.5	183 08 33.0	+1 20 03.9	1.646 626	183.12758	0.446 775	-0.45
Mar. 3	9552.5	184 55 56.3	1 17 37.5	.644 126	184.91737	.448 134	.45
7	9556.5	186 43 39.5	1 15 06.1	.641 483	186.71276	.449 576	.46
11	9560.5	188 31 43.9	1 12 29.8	.638 700	188.51409	.451 105	.47
15	9564.5	190 20 10.7	1 09 48.6	.635 779	190.32171	.452 717	.47
19	9568.5	192 09 01.2	+1 07 02.6	1.632 722	192.13594	0.454 413	-0.47
23	9572.5	193 58 16.4	1 04 11.9	.629 532	193.95713	.456 195	.46
27	9576.5	195 47 57.7	1 01 16.6	.626 211	195.78561	.458 058	.46
31	9580.5	197 38 06.2	0 58 16.9	.622 763	197.62171	.460 007	.46
Apr. 4	9584.5	199 28 43.2	0 55 12.7	.619 189	199.46578	.462 039	.46
8	9588.5	201 19 49.8	+0 52 04.3	1.615 495	201.31813	0.464 154	-0.45
12	9592.5	203 11 27.3	0 48 51.7	.611 682	203.17912	.466 353	.45
16	9596.5	205 03 36.9	0 45 35.0	.607 754	205.04906	.468 632	.44
20	9600.5	206 56 19.7	0 42 14.5	.603 716	206.92829	.470 998	.44
24	9604.5	208 49 37.0	0 38 50.2	.599 570	208.81715	.473 443	.44
28	9608.5	210 43 29.9	+0 35 22.2	1.595 320	210.71594	0.475 966	-0.43
May 2	9612.5	212 37 59.5	0 31 50.8	.590 972	212.62499	.478 572	.43
6	9616.5	214 33 07.1	0 28 16.1	.586 528	214.54462	.481 257	.42
10	9620.5	216 28 53.8	0 24 38.2	.581 994	216.47515	.484 020	.41
14	9624.5	218 25 20.7	0 20 57.4	.577 374	218.41688	.486 859	.41
18	9628.5	220 22 28.9	+0 17 13.8	1.572 674	220.37012	0.489 774	-0.40
22	9632.5	222 20 19.6	0 13 27.7	.567 897	222.33517	.492 763	.39
26	9636.5	224 18 53.7	0 09 39.2	.563 049	224.31232	.495 823	.38
30	9640.5	226 18 12.3	0 05 48.6	.558 136	226.30185	.498 956	.37
June 3	9644.5	228 18 16.5	+0 01 56.1	.553 163	228.30406	.502 157	.36
7	9648.5	230 19 07.2	-0 01 58.1	1.548 136	230.31919	0.505 421	-0.35
11	9652.5	232 20 45.4	0 05 53.6	.543 060	232.34752	.508 754	.35
15	9656.5	234 23 12.0	0 09 50.3	.537 943	234.38930	.512 145	.34
19	9660.5	236 26 27.9	0 13 47.7	.532 789	236.44476	.515 595	.33
23	9664.5	238 30 33.9	0 17 45.7	.527 605	238.51413	.519 099	.31
27	9668.5	240 35 30.8	-0 21 44.0	1.522 399	240.59762	0.522 656	-0.29
July 1	9672.5	242 41 19.4	-0 25 42.1	1.517 176	242.69544	0.526 260	-0.27

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
 MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion	Orb. Lat.
	243						
July 1	9672.5	242 41 19.4	-0 25 42.1	1.517 176	242.69544	0.526 260	-0.27
5	9676.5	244 48 00.3	0 29 39.8	.511 944	244.80776	.529 908	.26
9	9680.5	246 55 34.1	0 33 36.7	.506 710	246.93476	.533 598	.25
13	9684.5	249 04 01.5	0 37 32.4	.501 481	249.07659	.537 321	.23
17	9688.5	251 13 22.9	0 41 26.6	.496 264	251.23337	.541 073	.22
21	9692.5	253 23 38.7	-0 45 18.9	1.491 067	253.40521	0.544 853	-0.20
25	9696.5	255 34 49.3	0 49 08.9	.485 897	255.59222	.548 652	.19
29	9700.5	257 46 54.9	0 52 56.1	.480 763	257.79444	.552 462	.17
Aug. 2	9704.5	259 59 55.7	0 56 40.2	.475 672	260.01193	.556 281	.15
6	9708.5	262 13 51.8	1 00 20.6	.470 632	262.24469	.560 100	.14
10	9712.5	264 28 43.2	-1 03 57.1	1.465 651	264.49272	0.563 914	-0.12
14	9716.5	266 44 29.6	1 07 29.0	.460 737	266.75598	.567 713	.11
18	9720.5	269 01 11.0	1 10 56.0	.455 899	269.03440	.571 494	.09
22	9724.5	271 18 46.9	1 14 17.5	.451 144	271.32789	.575 244	.07
26	9728.5	273 37 16.9	1 17 33.1	.446 481	273.63630	.578 957	.06
30	9732.5	275 56 40.5	-1 20 42.4	1.441 918	275.95949	0.582 629	-0.04
Sept. 3	9736.5	278 16 56.9	1 23 44.9	.437 463	278.29726	.586 247	.03
7	9740.5	280 38 05.3	1 26 40.0	.433 124	280.64938	.589 802	-.02
11	9744.5	283 00 04.8	1 29 27.3	.428 910	283.01558	.593 286	.00
15	9748.5	285 22 54.2	1 32 06.4	.424 827	285.39556	.596 690	+ .02
19	9752.5	287 46 32.4	-1 34 36.7	1.420 885	287.78898	0.600 005	+0.03
23	9756.5	290 10 58.0	1 36 57.9	.417 090	290.19547	.603 223	.05
27	9760.5	292 36 09.5	1 39 09.5	.413 451	292.61462	.606 332	.07
Oct. 1	9764.5	295 02 05.2	1 41 11.1	.409 974	295.04597	.609 326	.09
5	9768.5	297 28 43.5	1 43 02.2	.406 667	297.48906	.612 195	.10
9	9772.5	299 56 02.4	-1 44 42.6	1.403 536	299.94335	0.614 927	+0.12
13	9776.5	302 23 59.9	1 46 11.7	.400 588	302.40829	.617 519	.13
17	9780.5	304 52 33.9	1 47 29.4	.397 830	304.88330	.619 959	.14
21	9784.5	307 21 42.1	1 48 35.3	.395 266	307.36775	.622 238	.15
25	9788.5	309 51 22.1	1 49 29.1	.392 904	309.86098	.624 350	.16
29	9792.5	312 21 31.5	-1 50 10.5	1.390 747	312.36232	0.626 291	+0.17
Nov. 2	9796.5	314 52 07.5	1 50 39.4	.388 800	314.87106	.628 046	.18
6	9800.5	317 23 07.6	1 50 55.6	.387 069	317.38644	.629 615	.19
10	9804.5	319 54 28.9	1 50 59.0	.385 556	319.90772	.630 991	.19
14	9808.5	322 26 08.6	1 50 49.5	.384 266	322.43410	.632 166	.20
18	9812.5	324 58 03.8	-1 50 27.0	1.383 200	324.96478	0.633 141	+0.20
22	9816.5	327 30 11.4	1 49 51.4	.382 363	327.49895	.633 907	.21
26	9820.5	330 02 28.4	1 49 03.0	.381 754	330.03576	.634 464	.22
30	9824.5	332 34 51.8	1 48 01.6	.381 377	332.57438	.634 812	.22
Dec. 4	9828.5	335 07 18.5	1 46 47.5	.381 231	335.11397	.634 946	.23
8	9832.5	337 39 45.3	-1 45 20.8	1.381 317	337.65366	0.634 865	+0.23
12	9836.5	340 12 09.2	1 43 41.8	.381 635	340.19261	.634 573	.24
16	9840.5	342 44 27.1	1 41 50.5	.382 185	342.72996	.634 069	.25
20	9844.5	345 16 35.9	1 39 47.4	.382 964	345.26488	.633 355	.26
24	9848.5	347 48 32.5	1 37 32.8	.383 971	347.79652	.632 431	.27
28	9852.5	350 20 14.1	-1 35 07.0	1.385 204	350.32406	0.631 306	+0.27
32	9856.5	352 51 37.6	-1 32 30.5	1.386 660	352.84670	0.629 981	+0.28

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
 MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
JUPITER						
Jan	0	243 117 48 43.9	10 23 49.5	5.253 000	117.81651	0.081 452
	10	0500.5 118 47 33.6	0 24 52.0	5.256 532	118.63049	0.081 343
	20	0510.5 119 26 19.4	0 25 56.0	5.260 042	119.44338	0.081 235
	30	0520.5 120 15 01.4	0 26 58.7	5.263 538	120.25510	0.081 127
Feb.	0	0530.5 121 03 39.5	0 28 01.0	5.267 010	121.06593	0.081 020
	10	0540.5 121 52 13.7	0 29 02.8	5.270 484	121.87560	0.080 914
Mar.	1	0550.5 122 40 44.2	0 30 04.2	5.273 933	122.68421	0.080 808
	11	0560.5 123 29 10.8	0 31 05.2	5.277 366	123.49176	0.080 703
	21	0570.5 124 17 33.8	0 32 05.8	5.280 780	124.29827	0.080 599
	31	0580.5 125 05 53.0	0 33 05.0	5.284 177	125.10374	0.080 495
Apr.	10	0590.5 125 54 08.5	10 34 05.5	5.287 555	125.90818	0.080 393
	20	0600.5 126 42 20.3	0 35 04.6	5.290 914	126.71160	0.080 291
	30	0610.5 127 30 28.5	0 36 03.3	5.294 252	127.51400	0.080 190
May	10	0620.5 128 18 33.1	0 37 01.4	5.297 570	128.31540	0.080 089
	20	0630.5 129 06 34.1	0 37 59.1	5.300 866	129.11579	0.079 990
	30	0640.5 129 54 31.6	10 38 56.2	5.304 141	129.91520	0.079 891
June	0	0650.5 130 42 25.5	0 39 52.8	5.307 393	130.71362	0.079 793
	10	0660.5 131 30 16.0	0 40 48.9	5.310 622	131.51107	0.079 696
	20	0670.5 132 18 03.0	0 41 44.4	5.313 827	132.30755	0.079 600
July	0	0680.5 133 05 46.6	0 42 39.4	5.317 008	133.10308	0.079 505
	10	0690.5 133 53 26.8	10 43 33.8	5.320 164	133.89766	0.079 411
	20	0700.5 134 41 03.7	0 44 27.7	5.323 295	134.69141	0.079 318
Aug.	8	0710.5 135 28 37.2	0 45 21.0	5.326 399	135.48402	0.079 226
	18	0720.5 136 16 07.4	0 46 13.7	5.329 477	136.27582	0.079 134
	28	0730.5 137 03 34.4	0 47 05.8	5.332 528	137.06671	0.079 044
Sept.	7	0740.5 137 50 58.2	10 47 57.3	5.335 551	137.85670	0.078 954
	17	0750.5 138 38 18.8	0 48 48.2	5.338 546	138.64580	0.078 866
	27	0760.5 139 25 36.2	0 49 38.5	5.341 512	139.43403	0.078 778
Oct.	7	0770.5 140 12 50.5	0 50 28.2	5.344 449	140.22138	0.078 692
	17	0780.5 141 00 01.8	0 51 17.3	5.347 356	141.00787	0.078 606
	27	0790.5 141 47 10.0	10 52 05.7	5.350 233	141.79351	0.078 522
Nov.	6	0800.5 142 34 15.2	0 52 53.5	5.353 079	142.57831	0.078 439
	16	0810.5 143 21 17.5	0 53 40.7	5.355 893	143.36228	0.078 356
	26	0820.5 144 08 16.8	0 54 27.2	5.358 676	144.14544	0.078 275
Dec.	6	0830.5 144 55 13.3	0 55 13.0	5.361 427	144.92779	0.078 195
	16	0840.5 145 42 06.9	10 55 58.2	5.364 144	145.70934	0.078 116
	26	0850.5 146 28 57.6	0 56 42.7	5.366 820	146.49011	0.078 038
	30	0860.5 147 15 45.7	10 57 26.6	5.369 470	147.27010	0.077 961
URANUS						
Dec.	21	0480.5 171 18 47.4	10 45 57.8	18.285 68	171.31250	0.012 9532
Jan.	30	0520.5 171 49 52.0	0 45 54.5	5.286 04	171.81064	0.012 9537
Mar.	11	0560.5 172 20 58.4	0 45 50.9	5.286 46	172.31880	0.012 9541
Apr.	20	0600.5 172 52 04.9	0 45 47.2	5.286 95	172.82696	0.012 9543
May	30	0640.5 173 23 00.6	0 45 43.1	5.287 40	173.33514	0.012 9544
July	0	0680.5 173 54 15.1	10 45 38.9	18.288 08	173.84332	0.012 9544
Aug.	18	0720.5 174 25 20.7	0 45 34.5	5.288 74	174.35149	0.012 9542
Sept.	27	0760.5 174 56 26.3	0 45 29.8	5.289 46	174.85965	0.012 9540
Nov.	6	0800.5 175 27 31.8	0 45 24.9	5.290 23	175.36780	0.012 9536
Dec.	16	0840.5 175 58 37.2	0 45 19.7	5.291 06	175.87594	0.012 9530
Jan.	25	0880.5 176 29 42.6	10 45 14.4	18.291 95	176.38404	0.012 9524

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
 MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
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SATURN						
	243					
Jan.	0 9490.5	359 41 01.4	- 2 16 41.8	9.534 334	359 70.305	0.033 500
	10 9500.5	0 01 08.6	2 17 02.7	9.528 257	0 03876	0.033 524
	20 9510.5	0 21 10.5	2 17 23.4	9.525 179	0 17407	0.033 542
	30 9520.5	0 41 25.2	2 17 43.8	9.522 101	0 70960	0.033 563
Feb.	9 9530.5	1 01 34.6	2 18 03.9	9.519 023	1 04534	0.033 584
	19 9540.5	1 21 44.9	- 2 18 23.8	9.515 945	1 38120	0.033 606
Mar.	1 9550.5	1 41 55.9	2 18 43.3	9.512 867	1 71745	0.033 627
	11 9560.5	2 02 07.7	2 19 02.7	9.509 789	2 05383	0.033 648
	21 9570.5	2 22 20.2	2 19 21.7	9.506 711	2 39042	0.033 669
	31 9580.5	2 42 33.6	2 19 40.4	9.503 634	2 72722	0.033 691
Apr.	10 9590.5	3 02 47.7	- 2 19 58.9	9.500 558	3 06423	0.033 712
	20 9600.5	3 23 02.6	2 20 17.1	9.497 482	3 40146	0.033 733
	30 9610.5	3 43 18.2	2 20 35.0	9.494 407	3 73890	0.033 755
May	10 9620.5	4 03 34.7	2 20 52.7	9.491 332	4 07655	0.033 776
	20 9630.5	4 23 51.9	2 21 10.0	9.488 259	4 41442	0.033 797
	30 9640.5	4 44 09.9	- 2 21 27.1	9.485 186	4 75250	0.033 819
June	9 9650.5	5 04 28.7	2 21 43.9	9.482 115	5 09080	0.033 840
	19 9660.5	5 24 48.3	2 22 00.4	9.479 045	5 42931	0.033 862
	29 9670.5	5 45 08.6	2 22 16.6	9.475 977	5 76803	0.033 883
July	9 9680.5	6 05 29.7	2 22 32.5	9.472 909	6 10697	0.033 905
	19 9690.5	6 25 51.6	- 2 22 48.1	9.469 844	6 44613	0.033 926
	29 9700.5	6 46 14.3	2 23 03.5	9.466 780	6 78550	0.033 948
Aug.	8 9710.5	7 06 37.8	2 23 18.5	9.463 718	7 12508	0.033 969
	18 9720.5	7 27 02.1	2 23 33.3	9.460 657	7 46488	0.033 991
	28 9730.5	7 47 27.1	2 23 47.8	9.457 599	7 80480	0.034 012
Sept.	7 9740.5	8 07 52.9	- 2 24 01.9	9.454 543	8 14512	0.034 034
	17 9750.5	8 28 19.5	2 24 15.8	9.451 489	8 48557	0.034 055
	27 9760.5	8 48 46.9	2 24 29.4	9.448 437	8 82623	0.034 077
Oct.	7 9770.5	9 09 15.1	2 24 42.7	9.445 387	9 16711	0.034 098
	17 9780.5	9 29 44.0	2 24 55.7	9.442 341	9 50820	0.034 120
	27 9790.5	9 50 13.8	- 2 25 08.3	9.439 296	9 84951	0.034 142
Nov.	6 9800.5	10 10 44.3	2 25 20.7	9.436 255	10 19103	0.034 163
	16 9810.5	10 31 15.6	2 25 32.8	9.433 216	10 53277	0.034 185
	26 9820.5	10 51 47.7	2 25 44.6	9.430 181	10 87472	0.034 206
Dec.	6 9830.5	11 12 20.5	2 25 56.1	9.427 148	11 21689	0.034 228
	16 9840.5	11 32 54.2	- 2 26 07.2	9.424 118	11 55928	0.034 249
	26 9850.5	11 53 28.6	2 26 18.1	9.421 092	11 90188	0.034 271
	36 9860.5	12 14 03.8	- 2 26 28.7	9.418 069	12 24470	0.034 293
NEPTUNE						
Dec.	21 9480.5	232 07 57.7	+1 44 31.4	30.322 63	232 12766	0.005 9117
Jan.	30 9520.5	232 22 09.4	1 44 26.4	322 70	232 36414	0.005 9123
Mar.	11 9560.5	232 36 21.2	1 44 21.3	322 76	232 60065	0.005 9130
Apr.	20 9600.5	232 50 33.1	1 44 16.1	322 83	232 83718	0.005 9136
May	30 9640.5	233 04 45.0	1 44 10.9	322 90	233 07373	0.005 9143
July	9 9680.5	233 18 57.1	+1 44 05.4	30.322 97	233 31032	0.005 9149
Aug.	18 9720.5	233 33 09.3	1 43 59.9	323 03	233 54693	0.005 9156
Sept.	27 9760.5	233 47 21.6	1 43 54.3	323 10	233 78357	0.005 9163
Nov.	6 9800.5	234 01 33.9	1 43 48.6	323 16	234 02023	0.005 9170
Dec.	16 9840.5	234 15 46.4	1 43 42.8	323 22	234 25692	0.005 9176
Jan.	25 9880.5	234 29 58.9	+1 43 36.8	30.323 27	234 49364	0.005 9183

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
	243					
Nov. 11	9440.5	168° 37' 15".9	+14° 46' 26".3	32.29529	169.75898	0.005 7963
Jan. 30	9520.5	169 05 45.0	14 50 37.6	32.25035	170.22340	.005 8142
Apr. 20	9600.5	169 34 20.3	14 54 46.1	32.20565	170.68925	.005 8320
July 9	9680.5	170 03 01.8	14 58 51.8	32.16119	171.15651	.005 8496
Sept. 27	9760.5	170 31 49.3	+15 02 54.7	32.11697	171.62518	0.005 8671
Dec. 16	9840.5	171 00 42.8	15 06 54.8	32.07298	172.09525	.005 8844
Mar. 5	9920.5	171 29 42.3	+15 10 52.0	32.02924	172.56668	0.005 9015

INNER PLANETS
MEAN ELEMENTS
MEAN EQUINOX AND ECLIPTIC OF DATE

Planet	Epoch 1967 April 20.0 = J.D. 243 9600.5 ; variations for 100 days					
	Inclination	Longitude of		Mean Distance	Mean Motion	Eccentricity
	i Var.	Ascending Node Ω Var.	Perihelion ϖ Var.	a	n	e
Mercury	7.00412 +1	47.94364 +325	76.94664 +426	0.387 099	4.092 339	0.205 628
Venus	3.39431 0	76.38541 +247	131.11097 +385	0.723 332	1.602 130	0.006 788
Mars	1.84989 0	49.30530 +211	335.45705 +504	1.523 691	0.524 033	0.093 375

Date	Julian Date	Mean Anomalies			Date	Julian Date	Mean Anomalies		
		Mercury	Venus	Mars			Mercury	Venus	Mars
	243					243			
Jan. 0	9490.5	163.749	177.530	182.580	July 9	9680.5	221.293	121.934	282.144
10	9500.5	204.673	193.551	187.820	19	9690.5	262.216	137.956	287.384
20	9510.5	245.596	209.572	193.060	29	9700.5	303.139	153.977	292.624
30	9520.5	286.519	225.594	198.300	Aug. 8	9710.5	344.063	169.998	297.864
Feb. 9	9530.5	327.443	241.615	203.541	18	9720.5	24.986	186.020	303.104
19	9540.5	8.366	257.636	208.781	28	9730.5	65.909	202.041	308.345
Mar. 1	9550.5	49.289	273.658	214.021	Sept. 7	9740.5	106.833	218.062	313.585
11	9560.5	90.213	289.679	219.261	17	9750.5	147.756	234.084	318.825
21	9570.5	131.136	305.700	224.501	27	9760.5	188.680	250.105	324.065
31	9580.5	172.059	321.721	229.742	Oct. 7	9770.5	229.603	266.126	329.305
Apr. 10	9590.5	212.983	337.743	234.982	17	9780.5	270.526	282.147	334.546
20	9600.5	253.906	353.764	240.222	27	9790.5	311.450	298.169	339.786
30	9610.5	294.829	9.785	245.462	Nov. 6	9800.5	352.373	314.190	345.026
May 10	9620.5	335.753	25.807	250.702	16	9810.5	33.296	330.211	350.266
20	9630.5	16.676	41.828	255.943	26	9820.5	74.220	346.233	355.507
30	9640.5	57.599	57.849	261.183	Dec. 6	9830.5	115.143	2.254	0.747
June 9	9650.5	98.523	73.871	266.423	16	9840.5	156.066	18.275	5.987
19	9660.5	139.446	89.892	271.663	26	9850.5	196.990	34.297	11.227
29	9670.5	180.369	105.913	276.903	36	9860.5	237.913	50.318	16.467

OSCULATING ELEMENTS
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Inclination i	Longitude of Asc. Node Ω	Perihelion ϖ	Mean Distance a	Mean Motion n	Eccen- tricity e	Mean Anomaly
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JUPITER

	243							
Jan. 30	9520.5	1.30601	100.1156	13.5397	5.202 639	0.083 0952	0.048 2162	101.3701
Mar. 11	9560.5	1.30601	100.1166	13.5474	5.202 666	0.083 0945	0.048 2147	104.6878
Apr. 20	9600.5	1.30601	100.1176	13.5550	5.202 694	0.083 0939	0.048 2131	108.0054
May 30	9640.5	1.30601	100.1186	13.5626	5.202 721	0.083 0932	0.048 2113	111.3231
July 9	9680.5	1.30601	100.1196	13.5701	5.202 749	0.083 0925	0.048 2094	114.6407
Aug. 18	9720.5	1.30601	100.1206	13.5776	5.202 777	0.083 0919	0.048 2073	117.9584
Sept. 27	9760.5	1.30600	100.1216	13.5850	5.202 804	0.083 0912	0.048 2051	121.2761
Nov. 6	9800.5	1.30600	100.1226	13.5922	5.202 831	0.083 0906	0.048 2028	124.5939
Dec. 16	9840.5	1.30600	100.1237	13.5994	5.202 857	0.083 0899	0.048 2004	127.9118

SATURN

Jan. 30	9520.5	2.48876	113.4314	92.1316	9.538 109	0.033 4636	0.055 1870	274.9033
Mar. 11	9560.5	2.48875	113.4329	92.2553	9.536 961	0.033 4696	0.055 1596	276.1170
Apr. 20	9600.5	2.48875	113.4342	92.3756	9.535 836	0.033 4756	0.055 1278	277.3342
May 30	9640.5	2.48874	113.4354	92.4921	9.534 736	0.033 4814	0.055 0919	278.5551
July 9	9680.5	2.48873	113.4365	92.6048	9.533 660	0.033 4870	0.055 0520	279.7799
Aug. 18	9720.5	2.48872	113.4375	92.7134	9.532 610	0.033 4926	0.055 0083	281.0088
Sept. 27	9760.5	2.48871	113.4384	92.8178	9.531 587	0.033 4980	0.054 9612	282.2419
Nov. 6	9800.5	2.48870	113.4392	92.9178	9.530 590	0.033 5032	0.054 9107	283.4795
Dec. 16	9840.5	2.48868	113.4399	93.0133	9.529 621	0.033 5083	0.054 8573	284.7216

URANUS

Jan. 30	9520.5	0.77250	73.9167	168.9690	19.246 74	0.011 6729	0.049 9711	2.5861
Mar. 11	9560.5	0.77250	73.9189	169.0597	19.249 89	0.011 6700	0.050 1231	2.9715
Apr. 20	9600.5	0.77250	73.9208	169.1552	19.252 90	0.011 6673	0.050 2674	3.3525
May 30	9640.5	0.77250	73.9225	169.2549	19.255 77	0.011 6647	0.050 4037	3.7294
July 9	9680.5	0.77250	73.9239	169.3587	19.258 48	0.011 6622	0.050 5318	4.1026
Aug. 18	9720.5	0.77250	73.9251	169.4661	19.261 05	0.011 6599	0.050 6515	4.4724
Sept. 27	9760.5	0.77250	73.9261	169.5768	19.263 46	0.011 6577	0.050 7628	4.8392
Nov. 6	9800.5	0.77250	73.9268	169.6903	19.265 71	0.011 6556	0.050 8655	5.2033
Dec. 16	9840.5	0.77251	73.9273	169.8064	19.267 81	0.011 6537	0.050 9596	5.5650

NEPTUNE

Jan. 30	9520.5	1.77308	131.3933	55.4990	30.030 84	0.005 9891	0.009 7333	176.8037
Mar. 11	9560.5	1.77309	131.3917	55.8634	30.037 51	0.005 9871	0.009 5124	176.6748
Apr. 20	9600.5	1.77310	131.3902	56.2011	30.044 27	0.005 9851	0.009 2879	176.5732
May 30	9640.5	1.77310	131.3889	56.5100	30.051 12	0.005 9831	0.009 0604	176.5011
July 9	9680.5	1.77311	131.3877	56.7878	30.058 04	0.005 9810	0.008 8305	176.4608
Aug. 18	9720.5	1.77311	131.3867	57.0321	30.064 99	0.005 9789	0.008 5990	176.4545
Sept. 27	9760.5	1.77312	131.3858	57.2402	30.071 97	0.005 9769	0.008 3663	176.4852
Nov. 6	9800.5	1.77312	131.3852	57.4089	30.078 96	0.005 9748	0.008 1330	176.5559
Dec. 16	9840.5	1.77312	131.3847	57.5352	30.085 94	0.005 9727	0.007 8998	176.6696

PLUTO

Jan. 30	9520.5	17.12606	109.7683	222.8258	39.616 93	0.003 9526	0.249 8417	327.6558
Apr. 20	9600.5	17.12631	109.7729	222.7818	39.640 92	0.003 9490	0.250 2780	328.0351
July 9	9680.5	17.12675	109.7787	222.7486	39.663 12	0.003 9457	0.250 7003	328.4054
Sept. 27	9760.5	17.12736	109.7856	222.7261	39.683 37	0.003 9427	0.251 1041	328.7666
Dec. 16	9840.5	17.12812	109.7935	222.7142	39.701 50	0.003 9400	0.251 4853	329.1185

MERCURY, 1967

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Jan. 0	17 52 59.66 +405.47	-24 09 15.1 - 410.7	2.39	6.30	1.395 723 + 6 103	11 18 26
1	17 59 45.13 407.56	24 16 05.8 334.8	2.38	6.28	.401 826 + 5 553	11 21 16
2	18 06 32.69 409.52	24 21 40.6 257.4	2.37	6.25	.407 379 5 008	11 24 08
3	18 13 22.21 411.39	24 25 58.0 178.8	2.36	6.23	.412 387 4 465	11 27 03
4	18 20 13.60 413.14	24 28 56.8 99.0	2.36	6.21	.416 852 3 925	11 29 59
5	18 27 06.74 +414.79	-24 30 35.8 - 18.0	2.35	6.19	1.420 777 + 3 386	11 32 56
6	18 34 01.53 416.33	24 30 53.8 + 64.2	2.35	6.18	.424 163 2 846	11 35 56
7	18 40 57.86 417.76	24 29 49.6 147.3	2.34	6.17	.427 009 2 306	11 38 57
8	18 47 55.62 419.09	24 27 22.3 231.6	2.34	6.16	.429 315 1 763	11 41 59
9	18 54 54.71 420.29	24 23 30.7 316.8	2.33	6.15	.431 078 1 217	11 45 02
10	19 01 55.00 +421.40	-24 18 13.9 + 402.9	2.33	6.14	1.432 295 + 668	11 48 07
11	19 08 56.40 422.38	24 11 31.0 489.9	2.33	6.14	.432 963 + 112	11 51 13
12	19 15 58.78 423.25	24 03 21.1 577.8	2.33	6.14	.433 075 - 451	11 54 19
13	19 23 02.03 424.02	23 53 43.3 666.5	2.33	6.14	.432 624 1 020	11 57 27
14	19 30 06.05 424.66	23 42 36.8 756.0	2.33	6.15	.431 604 1 600	12 00 35
15	19 37 10.71 +425.19	-23 30 00.8 + 846.0	2.34	6.15	1.430 004 - 2 191	12 03 44
16	19 44 15.90 425.60	23 15 54.8 936.9	2.34	6.16	.427 813 2 794	12 06 53
17	19 51 21.50 425.90	23 00 17.9 1028.2	2.34	6.18	.425 019 3 409	12 10 03
18	19 58 27.40 426.05	22 43 09.7 1120.1	2.35	6.19	.421 610 4 042	12 13 13
19	20 05 33.45 426.09	22 24 29.6 1212.3	2.36	6.21	.417 568 4 691	12 16 23
20	20 12 39.54 +425.97	-22 04 17.3 +1304.9	2.36	6.23	1.412 877 - 5 358	12 19 33
21	20 19 45.51 425.71	21 42 32.4 1397.6	2.37	6.25	.407 519 6 046	12 22 42
22	20 26 51.22 425.29	21 19 14.8 1490.4	2.38	6.28	.401 473 6 756	12 25 52
23	20 33 56.51 424.68	20 54 24.4 1583.2	2.39	6.31	.394 717 7 490	12 29 00
24	20 41 01.19 423.89	20 28 01.2 1675.6	2.41	6.34	.387 227 8 250	12 32 09
25	20 48 05.08 +422.87	-20 00 05.6 +1767.6	2.42	6.38	1.378 977 - 9 037	12 35 16
26	20 55 07.95 421.61	19 30 38.0 1858.8	2.44	6.42	.369 940 9 853	12 38 22
27	21 02 09.56 420.08	18 59 39.2 1949.1	2.46	6.47	.360 087 10 699	12 41 27
28	21 09 09.64 418.24	18 27 10.1 2037.9	2.48	6.52	.349 388 11 576	12 44 30
29	21 16 07.88 416.04	17 53 12.2 2124.9	2.50	6.58	.337 812 12 485	12 47 31
30	21 23 03.92 +413.43	-17 17 47.3 +2209.6	2.52	6.64	1.325 327 -13 427	12 50 29
31	21 29 57.35 410.34	16 40 57.7 2291.5	2.55	6.71	.311 900 14 401	12 53 25
Feb. 1	21 36 47.69 406.71	16 02 46.2 2369.6	2.57	6.78	.297 499 15 404	12 56 17
2	21 43 34.40 402.44	15 23 16.6 2443.4	2.61	6.86	.282 095 16 436	12 59 05
3	21 50 16.84 397.44	14 42 33.2 2511.7	2.64	6.95	.265 659 17 492	13 01 49
4	21 56 54.28 +391.57	-14 00 41.5 +2573.7	2.68	7.05	1.248 167 -18 567	13 04 27
5	22 03 25.85 384.74	13 17 47.8 2627.8	2.72	7.16	.229 600 19 654	13 06 59
6	22 09 50.59 376.80	12 34 00.0 2673.0	2.76	7.27	.209 946 20 743	13 09 23
7	22 16 07.39 367.56	11 49 27.0 2707.6	2.81	7.40	.189 203 21 823	13 11 38
8	22 22 14.95 356.93	11 04 19.4 2730.1	2.86	7.54	.167 380 22 881	13 13 44
9	22 28 11.88 +344.69	-10 18 49.3 +2738.3	2.92	7.69	1.144 499 -23 900	13 15 38
10	22 33 56.57 330.68	9 33 11.0 2730.9	2.98	7.85	.120 599 24 860	13 17 19
11	22 39 27.25 314.76	8 47 40.1 2706.0	3.05	8.03	.095 739 25 743	13 18 44
12	22 44 42.01 296.77	8 02 34.1 2661.4	3.12	8.22	.069 996 26 523	13 19 53
13	22 49 38.78 276.60	7 18 12.7 2595.8	3.20	8.43	.043 473 27 179	13 20 42
14	22 54 15.38 +254.14	- 6 34 56.9 +2507.6	3.29	8.66	1.016 294 -27 688	13 21 10
15	22 58 29.52	- 5 53 09.3	3.38	8.90	0.988 606	13 21 14

MERCURY, 1967
FOR 0^h EPHEMERIS TIME

179

Date	Apparent Right Ascension			Apparent Declination			Semi- diam- eter	Hor. Par.	True Distance from the Earth			Ephem- eris Transit
	h	m	s		°	'	"	"	"			h m s
Feb. 15	22	58	29.52	+229.38	—	5	53 09.3	+2395.6	3.38	8.90	0.988 606	13 21 14
16	23	02	18.90	202.33		5	13 13.7	2259.0	3.48	9.16	.960 579	13 20 52
17	23	05	41.23	173.10		4	35 34.7	2097.6	3.58	9.44	.932 403	13 20 02
18	23	08	34.33	141.82		4	00 37.1	1911.4	3.69	9.73	.904 284	13 18 41
19	23	10	56.15	108.80		3	28 45.7	1701.2	3.81	10.04	.876 442	13 16 49
20	23	12	44.95	+ 74.36	—	3	00 24.5	+1468.7	3.93	10.36	0.849 102	13 14 22
21	23	13	59.31	38.97		2	35 55.8	1215.7	4.06	10.70	.822 494	13 11 21
22	23	14	38.28	+ 3.17		2	15 40.1	945.6	4.19	11.04	.796 844	13 07 44
23	23	14	41.45	— 32.41		1	59 54.5	661.8	4.32	11.39	.772 371	13 03 32
24	23	14	09.04	67.05		1	48 52.7	369.0	4.46	11.74	.749 280	12 58 45
25	23	13	01.99	— 99.99	—	1	42 43.7	+ 72.6	4.59	12.09	0.727 760	12 53 25
26	23	11	22.00	130.43		1	41 31.1	— 221.3	4.72	12.43	.707 976	12 47 33
27	23	09	11.57	157.62		1	45 12.4	506.1	4.84	12.75	.690 070	12 41 13
28	23	06	33.95	180.81		1	53 38.5	775.1	4.95	13.05	.674 156	12 34 28
Mar. 1	23	03	33.14	199.42		2	06 33.6	1021.8	5.06	13.33	.660 318	12 27 22
2	23	00	13.72	—212.97	—	2	23 35.4	—1239.9	5.15	13.57	0.648 609	12 20 01
3	22	56	40.75	221.22		2	44 15.3	1424.9	5.23	13.77	.639 049	12 12 29
4	22	52	59.53	224.07		3	08 00.2	1572.6	5.29	13.93	.631 628	12 04 51
5	22	49	15.46	221.71		3	34 12.8	1681.4	5.33	14.05	.626 308	11 57 14
6	22	45	33.75	214.44		4	02 14.2	1751.0	5.36	14.12	.623 021	11 49 41
7	22	41	59.31	—202.77	—	4	31 25.2	—1782.5	5.37	14.16	0.621 680	11 42 18
8	22	38	36.54	187.31		5	01 07.7	1778.7	5.37	14.14	.622 177	11 35 07
9	22	35	29.23	168.73		5	30 46.4	1743.3	5.35	14.09	.624 390	11 28 14
10	22	32	40.50	147.73		5	59 49.7	1680.5	5.32	14.01	.628 190	11 21 40
11	22	30	12.77	124.98		6	27 50.2	1594.9	5.27	13.89	.633 440	11 15 28
12	22	28	07.79	—101.09	—	6	54 25.1	—1491.1	5.22	13.75	0.640 004	11 09 39
13	22	26	26.70	76.62		7	19 16.2	1373.1	5.16	13.59	.647 748	11 04 14
14	22	25	10.08	52.02		7	42 09.3	1244.9	5.09	13.40	.656 543	10 59 13
15	22	24	18.06	27.70		8	02 54.2	1109.6	5.01	13.21	.666 267	10 54 37
16	22	23	50.36	— 3.92		8	21 23.8	969.9	4.93	13.00	.676 806	10 50 24
17	22	23	46.44	+ 19.07	—	8	37 33.7	— 828.2	4.85	12.79	0.688 055	10 46 35
18	22	24	05.51	41.11		8	51 21.9	686.1	4.77	12.57	.699 917	10 43 08
19	22	24	46.62	62.10		9	02 48.0	544.9	4.69	12.35	.712 307	10 40 02
20	22	25	48.72	82.00		9	11 52.9	405.8	4.61	12.14	.725 145	10 37 17
21	22	27	10.72	100.75		9	18 38.7	269.2	4.52	11.92	.738 364	10 34 51
22	22	28	51.47	+118.39	—	9	23 07.9	— 135.7	4.44	11.70	0.751 902	10 32 43
23	22	30	49.86	134.91		9	25 23.6	— 5.7	4.36	11.49	.765 704	10 30 53
24	22	33	04.77	150.38		9	25 29.3	+ 120.8	4.28	11.29	.779 722	10 29 18
25	22	35	35.15	164.83		9	23 28.5	243.8	4.21	11.08	.793 916	10 27 58
26	22	38	19.98	178.33		9	19 24.7	362.9	4.13	10.89	.808 247	10 26 53
27	22	41	18.31	+190.93	—	9	13 21.8	+ 478.8	4.06	10.70	0.822 685	10 26 00
28	22	44	29.24	202.70		9	05 23.0	590.9	3.99	10.51	.837 201	10 25 20
29	22	47	51.94	213.68		8	55 32.1	699.8	3.92	10.33	.851 771	10 24 51
30	22	51	25.62	223.94		8	43 52.3	805.3	3.86	10.16	.866 375	10 24 32
31	22	55	09.56	233.55		8	30 27.0	907.7	3.79	9.99	.880 993	10 24 24
Apr. 1	22	59	03.11	+242.56	—	8	15 19.3	+1007.1	3.73	9.83	0.895 610	10 24 25
2	23	03	05.67		—	7	58 32.2		3.67	9.67	0.910 212	10 24 35

MERCURY, 1967
FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension			Apparent Declination			Semi- diam- eter	Hor. Par.	True Distance from the Earth			Ephem- eris Transit
	h	m	s	°	'	"	"	"				h m s
Apr.	1	22 59 03.11		- 8 15 19.3			3.73	9.83	0.895 610			10 24 25
	2	23 03 05.67	+242.56	7 58 32.2	+1007.1		3.67	9.67	.910 212	+14 602		10 24 35
	3	23 07 16.68	251.01	7 40 08.6	1103.6		3.61	9.52	.924 788	14 576		10 24 53
	4	23 11 35.66	258.98	7 20 11.2	1197.4		3.56	9.37	.939 326	14 538		10 25 18
	5	23 16 02.16	266.50	6 58 42.7	1288.5		3.50	9.23	.953 818	14 492		10 25 52
			273.62		1377.2					14 438		
	6	23 20 35.78		- 6 35 45.5			3.45	9.09	0.968 256			10 26 32
	7	23 25 16.19	+280.41	6 11 22.0	+1463.5		3.40	8.96	.982 632	+14 376		10 27 18
	8	23 30 03.07	286.88	5 45 34.5	1547.5		3.35	8.83	0.996 939	14 307		10 28 11
	9	23 34 56.16	293.09	5 18 25.3	1629.2		3.30	8.70	1.011 171	14 232		10 29 11
	10	23 39 55.25	299.09	4 49 56.3	1709.0		3.26	8.58	.025 321	14 150		10 30 16
			304.89		1786.7					14 062		
	11	23 45 00.14		- 4 20 09.6			3.21	8.47	1.039 383			10 31 27
	12	23 50 10.70	+310.56	3 49 07.2	+1862.4		3.17	8.35	.053 350	+13 967		10 32 43
	13	23 55 26.79	316.09	3 16 50.9	1936.3		3.13	8.25	.067 214	13 864		10 34 05
	14	0 00 48.33	321.54	2 43 22.8	2008.1		3.09	8.14	.080 969	13 755		10 35 33
	15	0 06 15.28	326.95	2 08 44.5	2078.3		3.05	8.04	.094 605	13 636		10 37 06
			332.33		2146.6					13 507		
	16	0 11 47.61		- 1 32 57.9			3.01	7.94	1.108 112			10 38 44
	17	0 17 25.32	+337.71	0 56 04.9	+2213.0		2.98	7.85	.121 480	+13 368		10 40 27
	18	0 23 08.45	343.13	- 0 18 07.3	2277.6		2.94	7.76	.134 696	13 216		10 42 17
	19	0 28 57.05	348.60	+ 0 20 53.2	2340.5		2.91	7.67	.147 746	13 050		10 44 11
	20	0 34 51.22	354.17	1 00 54.4	2401.2		2.88	7.58	.160 614	12 868		10 46 12
			359.84		2460.2					12 667		
	21	0 40 51.06		+ 1 41 54.6			2.85	7.50	1.173 281			10 48 18
	22	0 46 56.72	+365.66	2 23 51.6	+2517.0		2.82	7.42	.185 726	+12 445		10 50 30
	23	0 53 08.34	371.62	3 06 43.3	2571.7		2.79	7.35	.197 926	12 200		10 52 48
	24	0 59 26.12	377.78	3 50 27.4	2624.1		2.76	7.27	.209 853	11 927		10 55 12
	25	1 05 50.26	384.14	4 35 01.4	2674.0		2.73	7.20	.221 477	11 624		10 57 43
			390.71		2721.1					11 285		
	26	1 12 20.97		+ 5 20 22.5			2.71	7.14	1.232 762			11 00 20
	27	1 18 58.47	+397.50	6 06 27.7	+2765.2		2.69	7.08	.243 671	+10 909		11 03 05
	28	1 25 43.01	404.54	6 53 13.8	2806.1		2.66	7.02	.254 160	10 489		11 05 56
	29	1 32 34.82	411.81	7 40 37.0	2843.2		2.64	6.96	.264 181	10 021		11 08 56
	30	1 39 34.14	419.32	8 28 33.2	2876.2		2.62	6.91	.273 683	9 502		11 12 02
			427.07		2904.4					8 924		
May	1	1 46 41.21		+ 9 16 57.6			2.60	6.86	1.282 607			11 15 17
	2	1 53 56.25	+435.04	10 05 45.2	+2927.6		2.59	6.82	.290 890	+ 8 283		11 18 40
	3	2 01 19.46	443.21	10 54 50.1	2944.9		2.57	6.78	.298 467	7 577		11 22 11
	4	2 08 50.99	451.53	11 44 05.9	2955.8		2.56	6.74	.305 265	6 798		11 25 50
	5	2 16 30.98	459.99	12 33 25.2	2959.3		2.55	6.71	.311 210	5 945		11 29 38
			468.50		2954.8					5 013		
	6	2 24 19.48		+13 22 40.0			2.54	6.69	1.316 223			11 33 35
	7	2 32 16.46	+476.98	14 11 41.5	+2941.5		2.53	6.67	.320 225	+ 4 002		11 37 40
	8	2 40 21.84	485.38	15 00 20.2	2918.7		2.52	6.65	.323 138	2 913		11 41 54
	9	2 48 35.38	493.54	15 48 25.3	2885.1		2.52	6.64	.324 883	1 745		11 46 16
	10	2 56 56.75	501.37	16 35 46.0	2840.7		2.52	6.64	.325 390	+ 507		11 50 45
			508.75		2784.2					- 797		
	11	3 05 25.50		+17 22 10.2			2.52	6.64	1.324 593			11 55 21
	12	3 14 01.01	+515.51	18 07 25.9	+2715.7		2.53	6.65	.322 438	- 2 155		12 00 04
	13	3 22 42.53	521.52	18 51 20.7	2634.8		2.53	6.67	.318 882	3 556		12 04 53
	14	3 31 29.16	526.63	19 33 42.1	2541.4		2.54	6.70	.313 901	4 981		12 09 46
	15	3 40 19.87	530.71	20 14 18.2	2436.1		2.55	6.73	.307 483	6 418		12 14 43
			533.67		2319.3					7 844		
	16	3 49 13.54		+20 52 57.5			2.57	6.77	1.299 639			12 19 42
	17	3 58 08.93	+535.39	+21 29 29.6	+2192.1		2.59	6.82	1.290 398	- 9 241		12 24 43

MERCURY, 1967
FOR 0^h EPHEMERIS TIME

181

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] [″]	[″]	[″]		^h ^m ^s
May 17	3 58 08.93	+21 29 29.6	2.59	6.82	1.290 398	12 24 43
18	4 07 04.73	22 03 45.2	2.61	6.88	1.279 806	12 29 42
19	4 15 59.63	22 35 36.7	2.63	6.94	1.267 928	12 34 41
20	4 24 52.28	23 04 57.6	2.66	7.01	1.254 843	12 39 36
21	4 33 41.38	23 31 43.6	2.69	7.09	1.240 642	12 44 27
22	4 42 25.66	+23 55 51.7	2.73	7.18	1.225 423	12 49 13
23	4 51 03.93	24 17 20.6	2.76	7.28	1.209 294	12 53 52
24	4 59 35.07	24 36 10.6	2.80	7.38	1.192 361	12 58 23
25	5 07 58.07	24 52 23.3	2.84	7.49	1.174 732	13 02 45
26	5 16 12.00	25 06 01.5	2.89	7.61	1.156 512	13 06 58
27	5 24 16.01	+25 17 09.0	2.94	7.73	1.137 802	13 11 01
28	5 32 09.37	25 25 50.3	2.99	7.87	1.118 697	13 14 52
29	5 39 51.42	25 32 10.8	3.04	8.01	1.099 285	13 18 31
30	5 47 21.59	25 36 16.1	3.09	8.15	1.079 648	13 21 59
31	5 54 39.35	25 38 12.6	3.15	8.30	1.059 860	13 25 13
June 1	6 01 44.25	+25 38 06.5	3.21	8.46	1.039 989	13 28 15
2	6 08 35.89	25 36 04.5	3.27	8.63	1.020 094	13 31 02
3	6 15 13.90	25 32 13.2	3.34	8.80	1.000 231	13 33 36
4	6 21 37.94	25 26 39.6	3.41	8.98	0.980 448	13 35 56
5	6 27 47.71	25 19 30.1	3.48	9.16	0.960 789	13 38 01
6	6 33 42.91	+25 10 51.7	3.55	9.35	0.941 292	13 39 51
7	6 39 23.25	25 00 50.8	3.62	9.54	0.921 993	13 41 27
8	6 44 48.48	24 49 34.2	3.70	9.75	0.902 922	13 42 47
9	6 49 58.29	24 37 08.3	3.78	9.95	0.884 109	13 43 51
10	6 54 52.42	24 23 39.5	3.86	10.17	0.865 580	13 44 40
11	6 59 30.58	+24 09 14.2	3.94	10.39	0.847 359	13 45 12
12	7 03 52.48	23 53 58.7	4.03	10.61	0.829 470	13 45 28
13	7 07 57.82	23 37 59.1	4.11	10.84	0.811 934	13 45 27
14	7 11 46.28	23 21 21.6	4.20	11.07	0.794 773	13 45 09
15	7 15 17.55	23 04 12.3	4.29	11.31	0.778 010	13 44 34
16	7 18 31.32	+22 46 37.2	4.39	11.55	0.761 665	13 43 41
17	7 21 27.25	22 28 42.4	4.48	11.80	0.745 761	13 42 30
18	7 24 05.04	22 10 33.9	4.57	12.05	0.730 321	13 41 01
19	7 26 24.37	21 52 17.5	4.67	12.30	0.715 369	13 39 13
20	7 28 24.96	21 33 59.4	4.77	12.55	0.700 930	13 37 06
21	7 30 06.53	+21 15 45.6	4.86	12.81	0.687 031	13 34 41
22	7 31 28.86	20 57 41.8	4.96	13.06	0.673 700	13 31 56
23	7 32 31.77	20 39 54.0	5.05	13.31	0.660 967	13 28 52
24	7 33 15.15	20 22 28.1	5.15	13.56	0.648 864	13 25 28
25	7 33 38.97	20 05 29.9	5.24	13.81	0.637 425	13 21 45
26	7 33 43.32	+19 49 05.0	5.33	14.04	0.626 683	13 17 43
27	7 33 28.39	19 33 19.0	5.42	14.27	0.616 677	13 13 22
28	7 32 54.53	19 18 17.5	5.50	14.49	0.607 445	13 08 42
29	7 32 02.27	19 04 05.6	5.58	14.69	0.599 027	13 03 44
30	7 30 52.32	18 50 48.4	5.65	14.88	0.591 464	12 58 30
July 1	7 29 25.58	+18 38 30.8	5.71	15.05	0.584 797	12 52 59
2	7 27 43.22	+18 27 17.2	5.77	15.20	0.579 069	12 47 14

MERCURY, 1967

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
July 1	7 29 25.58 ^s	+18 38 30.8	5.71	15.05	0.584 797	12 52 59
2	7 27 43.22 ^s	18 27 17.2	5.77	15.20	.579 069	12 47 14
3	7 25 46.59	18 17 11.7	5.82	15.32	.574 320	12 41 15
4	7 23 37.32	18 08 18.0	5.85	15.42	.570 591	12 35 05
5	7 21 17.26	18 00 39.2	5.88	15.50	.567 921	12 28 45
6	7 18 48.48	+17 54 17.9	5.90	15.54	0.566 345	12 22 18
7	7 16 13.23	17 49 16.1	5.90	15.55	.565 897	12 15 46
8	7 13 33.96	17 45 35.3	5.89	15.53	.566 606	12 09 11
9	7 10 53.21	17 43 16.0	5.88	15.48	.568 497	12 02 35
10	7 08 13.62	17 42 18.1	5.84	15.40	.571 591	11 56 02
11	7 05 37.84	+17 42 40.9	5.80	15.28	0.575 901	11 49 35
12	7 03 08.52	17 44 22.9	5.74	15.13	.581 440	11 43 15
13	7 00 48.21	17 47 21.7	5.68	14.96	.588 210	11 37 05
14	6 58 39.36	17 51 34.3	5.60	14.76	.596 212	11 31 07
15	6 56 44.28	17 56 57.2	5.52	14.53	.605 438	11 25 24
16	6 55 05.05	+18 03 25.7	5.42	14.29	0.615 878	11 19 58
17	6 53 43.58	18 10 54.9	5.32	14.02	.627 517	11 14 50
18	6 52 41.53	18 19 19.2	5.22	13.74	.640 333	11 10 02
19	6 52 00.34	18 28 32.1	5.10	13.45	.654 303	11 05 35
20	6 51 41.23	18 38 27.1	4.99	13.15	.669 398	11 01 31
21	6 51 45.20	+18 48 56.6	4.87	12.84	0.685 587	10 57 49
22	6 52 13.05	18 59 53.0	4.75	12.52	.702 833	10 54 32
23	6 53 05.41	19 11 07.9	4.63	12.20	.721 099	10 51 40
24	6 54 22.72	19 22 32.6	4.51	11.89	.740 341	10 49 12
25	6 56 05.27	19 33 58.0	4.39	11.57	.760 512	10 47 10
26	6 58 13.24	+19 45 14.6	4.27	11.26	0.781 562	10 45 33
27	7 00 46.68	19 56 12.4	4.16	10.95	.803 433	10 44 21
28	7 03 45.50	20 06 41.4	4.04	10.65	.826 065	10 43 34
29	7 07 09.56	20 16 30.7	3.93	10.36	.849 389	10 43 13
30	7 10 58.56	20 25 29.5	3.82	10.08	.873 331	10 43 17
31	7 15 12.13	+20 33 26.9	3.72	9.80	0.897 808	10 43 45
Aug. 1	7 19 49.78	20 40 11.4	3.62	9.54	.922 729	10 44 36
2	7 24 50.92	20 45 31.7	3.52	9.28	.947 994	10 45 51
3	7 30 14.79	20 49 16.6	3.43	9.04	.973 495	10 47 28
4	7 36 00.55	20 51 14.7	3.34	8.81	0.999 114	10 49 27
5	7 42 07.15	+20 51 15.6	3.26	8.59	1.024 723	10 51 47
6	7 48 33.44	20 49 09.0	3.18	8.38	.050 190	10 54 25
7	7 55 18.08	20 44 45.8	3.11	8.18	.075 376	10 57 22
8	8 02 19.56	20 37 57.9	3.04	8.00	.100 139	11 00 34
9	8 09 36.26	20 28 38.7	2.97	7.83	.124 337	11 04 01
10	8 17 06.40	+20 16 43.1	2.91	7.67	1.147 830	11 07 41
11	8 24 48.11	20 02 07.8	2.85	7.52	.170 486	11 11 31
12	8 32 39.44	19 44 51.6	2.80	7.38	.192 183	11 15 31
13	8 40 38.43	19 24 55.1	2.75	7.26	.212 812	11 19 37
14	8 48 43.13	19 02 21.0	2.71	7.14	.232 282	11 23 47
15	8 56 51.63	+18 37 13.8	2.67	7.04	1.250 517	11 28 01
16	9 05 02.13	+18 09 39.6	2.64	6.94	1.267 465	11 32 16

MERCURY, 1967
FOR 0^h EPHEMERIS TIME

183

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Aug. 16	9 05 02.13 ^s	+18 09 39.6	2.64	6.94	1.267 465	11 32 16
17	9 13 12.97 ^s	17 39 46.0	2.60	6.86	.283 088	11 36 31
18	9 21 22.64	17 07 41.5	2.57	6.78	.297 372	11 40 44
19	9 29 29.81	16 33 35.5	2.55	6.72	.310 315	11 44 53
20	9 37 33.34	15 57 37.8	2.53	6.66	.321 933	11 48 59
21	9 45 32.27	+15 19 58.7	2.51	6.61	1.332 255	11 52 59
22	9 53 25.81	14 40 48.1	2.49	6.56	.341 319	11 56 54
23	10 01 13.37	14 00 16.0	2.48	6.52	.349 170	12 00 43
24	10 08 54.47	13 18 32.0	2.46	6.49	.355 859	12 04 24
25	10 16 28.80	12 35 45.2	2.45	6.46	.361 440	12 07 59
26	10 23 56.15	+11 52 04.1	2.45	6.44	1.365 971	12 11 27
27	10 31 16.41	11 07 36.9	2.44	6.43	.369 507	12 14 48
28	10 38 29.57	10 22 30.9	2.43	6.41	.372 103	12 18 01
29	10 45 35.65	9 36 53.0	2.43	6.41	.373 814	12 21 07
30	10 52 34.78	8 50 49.5	2.43	6.40	.374 690	12 24 07
31	10 59 27.07	+ 8 04 26.2	2.43	6.40	1.374 780	12 26 59
Sept. 1	11 06 12.72	7 17 48.3	2.43	6.40	.374 130	12 29 45
2	11 12 51.92	6 31 00.7	2.43	6.41	.372 780	12 32 25
3	11 19 24.88	5 44 07.8	2.44	6.42	.370 771	12 34 59
4	11 25 51.83	4 57 13.5	2.44	6.43	.368 136	12 37 26
5	11 32 12.99	+ 4 10 21.5	2.45	6.45	1.364 911	12 39 48
6	11 38 28.61	3 23 35.2	2.45	6.47	.361 122	12 42 04
7	11 44 38.92	2 36 57.5	2.46	6.49	.356 798	12 44 16
8	11 50 44.15	1 50 31.4	2.47	6.51	.351 961	12 46 22
9	11 56 44.51	1 04 19.3	2.48	6.53	.346 635	12 48 23
10	12 02 40.22	+ 0 18 23.7	2.49	6.56	1.340 838	12 50 20
11	12 08 31.49	- 0 27 13.1	2.50	6.59	.334 587	12 52 13
12	12 14 18.51	1 12 29.2	2.52	6.63	.327 898	12 54 01
13	12 20 01.45	1 57 22.4	2.53	6.66	.320 783	12 55 46
14	12 25 40.48	2 41 51.1	2.54	6.70	.313 254	12 57 26
15	12 31 15.76	- 3 25 53.3	2.56	6.74	1.305 320	12 59 03
16	12 36 47.43	4 09 27.4	2.58	6.78	.296 991	13 00 36
17	12 42 15.62	4 52 31.8	2.59	6.83	.288 273	13 02 06
18	12 47 40.44	5 35 05.0	2.61	6.88	.279 172	13 03 33
19	12 53 01.97	6 17 05.3	2.63	6.93	.269 692	13 04 56
20	12 58 20.30	- 6 58 31.2	2.65	6.99	1.259 838	13 06 16
21	13 03 35.48	7 39 21.2	2.67	7.04	.249 611	13 07 33
22	13 08 47.56	8 19 33.8	2.70	7.10	.239 014	13 08 47
23	13 13 56.54	8 59 07.2	2.72	7.17	.228 048	13 09 58
24	13 19 02.41	9 38 00.1	2.75	7.23	.216 714	13 11 06
25	13 24 05.14	-10 16 10.6	2.77	7.30	1.205 011	13 12 10
26	13 29 04.66	10 53 37.1	2.80	7.38	.192 940	13 13 11
27	13 34 00.88	11 30 17.6	2.83	7.45	.180 499	13 14 09
28	13 38 53.67	12 06 10.4	2.86	7.54	.167 689	13 15 03
29	13 43 42.88	12 41 13.5	2.89	7.62	.154 508	13 15 54
30	13 48 28.29	-13 15 24.5	2.93	7.71	1.140 956	13 16 41
Oct. 1	13 53 09.66	-13 48 41.3	2.96	7.81	1.127 032	13 17 23

MERCURY, 1967
FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension			Apparent Declination			Semi- diam- eter	Hor. Par.	True Distance from the Earth			Ephem- eris Transit
	h	m	s	°	'	"	"	"				h m s
Oct.	1	13 53	09.66	+277.04	-13 48	41.3	2.96	7.81	1.127 032	-14 295		13 17 23
	2	13 57	46.70	272.36	14 21	01.4	3.00	7.91	.112 737	14 665		13 18 01
	3	14 02	19.06	267.28	14 52	22.2	3.04	8.01	.098 072	15 034		13 18 34
	4	14 06	46.34	261.73	15 22	40.7	3.08	8.13	.083 038	15 399		13 19 02
	5	14 11	08.07	255.63	15 51	53.8	3.13	8.24	.067 639	15 761		13 19 24
	6	14 15	23.70	+248.91	-16 19	58.2	3.18	8.37	1.051 878	-16 115		13 19 39
	7	14 19	32.61	241.49	16 46	50.2	3.22	8.50	.035 763	16 461		13 19 48
	8	14 23	34.10	233.25	17 12	25.6	3.28	8.63	.019 302	16 793		13 19 48
	9	14 27	27.35	224.10	17 36	39.9	3.33	8.78	1.002 509	17 112		13 19 40
	10	14 31	11.45	213.93	17 59	28.2	3.39	8.93	0.985 397	17 411		13 19 22
	11	14 34	45.38	+202.59	-18 20	45.0	3.45	9.09	0.967 986	-17 685		13 18 53
	12	14 38	07.97	190.00	18 40	24.2	3.51	9.26	.950 301	17 929		13 18 12
	13	14 41	17.97	175.97	18 58	19.0	3.58	9.44	.932 372	18 138		13 17 18
	14	14 44	13.94	160.37	19 14	21.8	3.65	9.63	.914 234	18 300		13 16 09
	15	14 46	54.31	143.07	19 28	24.3	3.73	9.82	.895 934	18 410		13 14 44
	16	14 49	17.38	+123.92	-19 40	17.2	3.81	10.03	0.877 524	-18 454		13 13 00
	17	14 51	21.30	102.76	19 49	49.9	3.89	10.24	.859 070	18 421		13 10 56
	18	14 53	04.06	79.53	19 56	51.2	3.97	10.47	.840 649	18 296		13 08 30
	19	14 54	23.59	54.13	20 01	08.2	4.06	10.70	.822 353	18 062		13 05 40
	20	14 55	17.72	+26.58	20 02	27.4	4.15	10.94	.804 291	17 702		13 02 23
	21	14 55	44.30	-3.04	-20 00	33.9	4.25	11.19	0.786 589	-17 195		12 58 38
	22	14 55	41.26	34.54	19 55	12.6	4.34	11.44	.769 394	16 519		12 54 22
	23	14 55	06.72	67.54	19 46	07.8	4.44	11.69	.752 875	15 652		12 49 35
	24	14 53	59.18	101.51	19 33	04.6	4.53	11.94	.737 223	14 572		12 44 14
	25	14 52	17.67	135.67	19 15	50.2	4.62	12.18	.722 651	13 257		12 38 19
	26	14 50	02.00	-169.01	-18 54	14.7	4.71	12.40	0.709 394	-11 691		12 31 51
	27	14 47	12.99	200.33	18 28	14.0	4.79	12.61	.697 703	9 862		12 24 51
	28	14 43	52.66	228.20	17 57	51.6	4.86	12.79	.687 841	7 770		12 17 21
	29	14 40	04.46	251.16	17 23	21.2	4.91	12.94	.680 071	5 423		12 09 27
	30	14 35	53.30	267.75	16 45	08.7	4.95	13.04	.674 648	2 846		12 01 13
Nov.	31	14 31	25.55	-276.73	-16 03	53.5	4.97	13.10	0.671 802	-78		11 52 46
	1	14 26	48.82	277.26	15 20	28.7	4.97	13.10	.671 724	+2 829		11 44 14
	2	14 22	11.56	268.96	14 35	59.0	4.95	13.05	.674 553	5 807		11 35 47
	3	14 17	42.60	252.03	13 51	37.3	4.91	12.93	.680 360	8 783		11 27 31
	4	14 13	30.57	227.27	13 08	39.7	4.85	12.77	.689 143	11 681		11 19 36
	5	14 09	43.30	-195.88	-12 28	19.3	4.77	12.56	0.700 824	+14 425		11 12 08
	6	14 06	27.42	159.39	11 51	41.9	4.67	12.30	.715 249	16 956		11 05 14
	7	14 03	48.03	119.48	11 19	40.8	4.56	12.02	.732 205	19 220		10 58 58
	8	14 01	48.55	77.76	10 52	54.9	4.44	11.71	.751 425	21 183		10 53 22
	9	14 00	30.79	-35.67	10 31	47.6	4.32	11.39	.772 608	22 823		10 48 28
	10	13 59	55.12	+5.55	-10 16	28.1	4.20	11.06	0.795 431	+24 139		10 44 15
	11	14 00	00.67	44.97	10 06	52.9	4.08	10.74	.819 570	25 135		10 40 42
	12	14 00	45.64	81.95	10 02	48.8	3.95	10.42	.844 705	25 832		10 37 48
	13	14 02	07.59	116.09	10 03	54.9	3.84	10.11	.870 537	26 251		10 35 29
	14	14 04	03.68	147.20	10 09	45.9	3.72	9.81	.896 788	26 425		10 33 43
	15	14 06	30.88	+175.22	-10 19	53.5	3.62	9.53	0.923 213	+26 383		10 32 26
	16	14 09	26.10		-10 33	48.6	3.52	9.27	0.949 596			10 31 36

MERCURY, 1967

FOR 0^h EPHEMERIS TIME

185

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Nov. 16	14 09 26.10 +200.26	-10 33 48.6 -1033.6	3.52	9.27	0.949 596 +26 157	10 31 36
17	14 12 46.36 222.51	10 51 02.2 1204.4	3.42	9.02	0.975 753 25 776	10 31 10
18	14 16 28.87 242.15	11 11 06.6 1349.1	3.33	8.79	1.001 529 25 270	10 31 05
19	14 20 31.02 259.45	11 33 35.7 1469.8	3.25	8.57	.026 799 24 662	10 31 18
20	14 24 50.47 274.64	11 58 05.5 1568.6	3.18	8.37	.051 461 23 977	10 31 48
21	14 29 25.11 +287.97	-12 24 14.1 -1647.8	3.11	8.18	1.075 438 +23 232	10 32 32
22	14 34 13.08 299.69	12 51 41.9 1709.5	3.04	8.01	.098 670 22 445	10 33 29
23	14 39 12.77 309.98	13 20 11.4 1755.7	2.98	7.85	.121 115 21 627	10 34 37
24	14 44 22.75 319.05	13 49 27.1 1787.9	2.92	7.70	.142 742 20 792	10 35 55
25	14 49 41.80 327.07	14 19 15.0 1808.2	2.87	7.56	.163 534 19 947	10 37 21
26	14 55 08.87 +334.20	-14 49 23.2 -1817.6	2.82	7.44	1.183 481 +19 101	10 38 55
27	15 00 43.07 340.55	15 19 40.8 1817.8	2.78	7.32	.202 582 18 258	10 40 35
28	15 06 23.62 346.25	15 49 58.6 1809.6	2.74	7.21	.220 840 17 423	10 42 22
29	15 12 09.87 351.40	16 20 08.2 1794.3	2.70	7.11	.238 263 16 600	10 44 14
30	15 18 01.27 356.07	16 50 02.5 1772.5	2.66	7.01	.254 863 15 790	10 46 11
Dec. 1	15 23 57.34 +360.34	-17 19 35.0 -1745.1	2.63	6.93	1.270 653 +14 997	10 48 13
2	15 29 57.68 364.28	17 48 40.1 1712.6	2.60	6.84	.285 650 14 219	10 50 19
3	15 36 01.96 367.93	18 17 12.7 1675.7	2.57	6.77	.299 869 13 459	10 52 29
4	15 42 09.89 371.32	18 45 08.4 1634.7	2.54	6.70	.313 328 12 715	10 54 42
5	15 48 21.21 374.52	19 12 23.1 1590.2	2.52	6.64	.326 043 11 991	10 56 58
6	15 54 35.73 +377.55	-19 38 53.3 -1542.5	2.50	6.58	1.338 034 +11 281	10 59 18
7	16 00 53.28 380.42	20 04 35.8 1491.7	2.48	6.52	.349 315 10 590	11 01 40
8	16 07 13.70 383.18	20 29 27.5 1438.4	2.46	6.47	.359 905 9 913	11 04 06
9	16 13 36.88 385.84	20 53 25.9 1382.6	2.44	6.42	.369 818 9 251	11 06 34
10	16 20 02.72 388.39	21 16 28.5 1324.5	2.42	6.38	.379 069 8 604	11 09 05
11	16 26 31.11 +390.87	-21 38 33.0 -1264.3	2.41	6.34	1.387 673 +7 969	11 11 38
12	16 33 01.98 393.28	21 59 37.3 1202.1	2.39	6.31	.395 642 7 347	11 14 14
13	16 39 35.26 395.62	22 19 39.4 1138.1	2.38	6.27	.402 989 6 735	11 16 52
14	16 46 10.88 397.90	22 38 37.5 1072.2	2.37	6.24	.409 724 6 135	11 19 32
15	16 52 48.78 400.12	22 56 29.7 1004.9	2.36	6.22	.415 859 5 541	11 22 15
16	16 59 28.90 +402.28	-23 13 14.6 -935.8	2.35	6.19	1.421 400 +4 957	11 25 00
17	17 06 11.18 404.38	23 28 50.4 865.1	2.34	6.17	.426 357 4 380	11 27 47
18	17 12 55.56 406.43	23 43 15.5 793.0	2.33	6.15	.430 737 3 808	11 30 36
19	17 19 41.99 408.40	23 56 28.5 719.5	2.33	6.13	.434 545 3 240	11 33 27
20	17 26 30.39 410.33	24 08 28.0 644.4	2.32	6.12	.437 785 2 677	11 36 20
21	17 33 20.72 +412.18	-24 19 12.4 -568.1	2.32	6.11	1.440 462 +2 116	11 39 15
22	17 40 12.90 413.95	24 28 40.5 490.4	2.32	6.10	.442 578 1 556	11 42 12
23	17 47 06.85 415.66	24 36 50.9 411.3	2.31	6.09	.444 134 996	11 45 11
24	17 54 02.51 417.29	24 43 42.2 331.0	2.31	6.09	.445 130 +436	11 48 11
25	18 00 59.80 418.83	24 49 13.2 249.4	2.31	6.09	.445 566 -127	11 51 13
26	18 07 58.63 +420.27	-24 53 22.6 -166.6	2.31	6.09	1.445 439 -693	11 54 16
27	18 14 58.90 421.62	24 56 09.2 -82.6	2.31	6.09	.444 746 1 262	11 57 21
28	18 22 00.52 422.87	24 57 31.8 +2.4	2.31	6.10	.443 484 1 839	12 00 27
29	18 29 03.39 423.98	24 57 29.4 88.7	2.32	6.10	.441 645 2 420	12 03 34
30	18 36 07.37 424.99	24 56 00.7 176.0	2.32	6.11	.439 225 3 010	12 06 43
31	18 43 12.36 +425.84	-24 53 04.7 +264.2	2.33	6.13	1.436 215 -3 609	12 09 52
32	18 50 18.20	-24 48 40.5	2.33	6.14	1.432 606	12 13 02

VENUS, 1967

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Jan. 0	19 33 31.41 ^s	-22 54 04.8	5.08	5.32	1.655 039	12 58 25
1	19 38 54.87 ^{+323.46}	22 43 25.7 ^{+ 639.1}	5.09	5.32	.652 890 ^{- 2 149}	12 59 52
2	19 44 17.43 ^{322.56}	22 32 05.3 ^{680.4}	5.09	5.33	.650 704 ^{2 186}	13 01 17
3	19 49 39.03 ^{321.60}	22 20 03.9 ^{721.4}	5.10	5.34	.648 482 ^{2 222}	13 02 42
4	19 54 59.64 ^{320.61}	22 07 22.2 ^{761.7}	5.11	5.35	.646 224 ^{2 258}	13 04 06
5	20 00 19.23 ^{319.59}	-21 54 00.5 ^{801.7}	5.12	5.35	1.643 928 ^{2 296}	13 05 28
6	20 05 37.75 ^{+318.52}	21 39 59.5 ^{+ 841.0}	5.12	5.36	.641 594 ^{- 2 334}	13 06 50
7	20 10 55.18 ^{317.43}	21 25 19.7 ^{879.8}	5.13	5.37	.639 223 ^{2 371}	13 08 10
8	20 16 11.47 ^{316.29}	21 10 01.8 ^{917.9}	5.14	5.38	.636 814 ^{2 409}	13 09 29
9	20 21 26.60 ^{315.13}	20 54 06.3 ^{955.5}	5.15	5.38	.634 367 ^{2 447}	13 10 47
10	20 26 40.53 ^{313.93}	-20 37 33.8 ^{992.5}	5.15	5.39	1.631 880 ^{2 487}	13 12 04
11	20 31 53.24 ^{+312.71}	20 20 25.2 ^{+1028.6}	5.16	5.40	.629 356 ^{- 2 524}	13 13 19
12	20 37 04.71 ^{311.47}	20 02 41.0 ^{1064.2}	5.17	5.41	.626 792 ^{2 564}	13 14 34
13	20 42 14.90 ^{310.19}	19 44 21.8 ^{1099.2}	5.18	5.42	.624 189 ^{2 603}	13 15 47
14	20 47 23.81 ^{308.91}	19 25 28.5 ^{1133.3}	5.19	5.43	.621 548 ^{2 641}	13 16 58
15	20 52 31.42 ^{307.61}	-19 06 01.8 ^{1166.7}	5.19	5.44	1.618 868 ^{2 680}	13 18 09
16	20 57 37.72 ^{+306.30}	18 46 02.2 ^{+1199.6}	5.20	5.45	.616 149 ^{- 2 719}	13 19 18
17	21 02 42.70 ^{304.98}	18 25 30.7 ^{1231.5}	5.21	5.45	.613 391 ^{2 758}	13 20 26
18	21 07 46.36 ^{303.66}	18 04 27.8 ^{1262.9}	5.22	5.46	.610 595 ^{2 796}	13 21 32
19	21 12 48.70 ^{302.34}	17 42 54.5 ^{1293.3}	5.23	5.47	.607 760 ^{2 835}	13 22 37
20	21 17 49.71 ^{301.01}	-17 20 51.4 ^{1323.1}	5.24	5.48	1.604 887 ^{2 873}	13 23 41
21	21 22 49.40 ^{+299.69}	16 58 19.3 ^{+1352.1}	5.25	5.49	.601 975 ^{- 2 912}	13 24 43
22	21 27 47.77 ^{298.37}	16 35 19.0 ^{1380.3}	5.26	5.50	.599 026 ^{2 949}	13 25 44
23	21 32 44.83 ^{297.06}	16 11 51.3 ^{1407.7}	5.27	5.51	.596 038 ^{2 988}	13 26 44
24	21 37 40.60 ^{295.77}	15 47 56.9 ^{1434.4}	5.28	5.52	.593 013 ^{3 025}	13 27 43
25	21 42 35.08 ^{294.48}	-15 23 36.7 ^{1460.2}	5.29	5.53	1.589 950 ^{3 063}	13 28 40
26	21 47 28.29 ^{+293.21}	14 58 51.5 ^{+1485.2}	5.30	5.55	.586 850 ^{- 3 100}	13 29 36
27	21 52 20.24 ^{291.95}	14 33 41.9 ^{1509.6}	5.31	5.56	.583 713 ^{3 137}	13 30 31
28	21 57 10.95 ^{290.71}	14 08 08.9 ^{1533.0}	5.32	5.57	.580 538 ^{3 175}	13 31 24
29	22 02 00.45 ^{289.50}	13 42 13.1 ^{1555.8}	5.33	5.58	.577 325 ^{3 213}	13 32 17
30	22 06 48.76 ^{288.31}	-13 15 55.3 ^{1577.8}	5.34	5.59	1.574 075 ^{3 250}	13 33 08
31	22 11 35.91 ^{+287.15}	12 49 16.3 ^{+1599.0}	5.35	5.60	.570 788 ^{- 3 287}	13 33 58
Feb. 1	22 16 21.93 ^{286.02}	12 22 16.9 ^{1619.4}	5.37	5.61	.567 462 ^{3 326}	13 34 47
2	22 21 06.84 ^{284.91}	11 54 57.8 ^{1639.1}	5.38	5.63	.564 097 ^{3 365}	13 35 34
3	22 25 50.68 ^{283.84}	11 27 19.8 ^{1658.0}	5.39	5.64	.560 694 ^{3 403}	13 36 21
4	22 30 33.47 ^{282.79}	-10 59 23.6 ^{1676.2}	5.40	5.65	1.557 251 ^{3 443}	13 37 07
5	22 35 15.24 ^{+281.77}	10 31 10.1 ^{+1693.5}	5.41	5.66	.553 768 ^{- 3 483}	13 37 51
6	22 39 56.02 ^{280.78}	10 02 40.1 ^{1710.0}	5.42	5.68	.550 245 ^{3 523}	13 38 35
7	22 44 35.85 ^{279.83}	9 33 54.4 ^{1725.7}	5.44	5.69	.546 681 ^{3 564}	13 39 18
8	22 49 14.74 ^{278.89}	9 04 53.7 ^{1740.7}	5.45	5.70	.543 076 ^{3 605}	13 40 00
9	22 53 52.74 ^{278.00}	- 8 35 38.8 ^{1754.9}	5.46	5.72	1.539 430 ^{3 646}	13 40 40
10	22 58 29.87 ^{+277.13}	8 06 10.5 ^{+1768.3}	5.48	5.73	.535 743 ^{- 3 687}	13 41 21
11	23 03 06.17 ^{276.30}	7 36 29.7 ^{1780.8}	5.49	5.74	.532 014 ^{3 729}	13 42 00
12	23 07 41.68 ^{275.51}	7 06 37.0 ^{1792.7}	5.50	5.76	.528 242 ^{3 772}	13 42 39
13	23 12 16.43 ^{274.75}	6 36 33.3 ^{1803.7}	5.52	5.77	.524 429 ^{3 813}	13 43 16
14	23 16 50.46 ^{274.03}	- 6 06 19.2 ^{1814.1}	5.53	5.79	1.520 574 ^{3 855}	13 43 53
15	23 21 23.81 ^{+273.35}	- 5 35 55.7 ^{+1823.5}	5.55	5.80	1.516 677 ^{- 3 897}	13 44 30

VENUS, 1967
FOR 0^h EPHEMERIS TIME

187

Date	Apparent Right Ascension			Apparent Declination			Semi- diam- eter	Hor. Par.	True Distance from the Earth			Ephem- eris Transit
	h	m	s	°	'	"	"	"				h m s
Feb. 15	23	21	23.81	+	5	35 55.7	+1832.2	5.55	5.80	1.516 677	- 3 940	13 44 30
16	23	25	56.51		5	05 23.5	1840.2	5.56	5.82	.512 737	3 981	13 45 06
17	23	30	28.61		4	34 43.3	1847.4	5.57	5.83	.508 756	4 024	13 45 41
18	23	35	00.14		4	03 55.9	1853.9	5.59	5.85	.504 732	4 066	13 46 16
19	23	39	31.15		3	33 02.0	1859.5	5.60	5.86	.500 666	4 108	13 46 50
20	23	44	01.66	+	3	02 02.5	+1864.5	5.62	5.88	1.496 558	- 4 150	13 47 23
21	23	48	31.73		2	30 58.0	1868.6	5.64	5.90	.492 408	4 192	13 47 57
22	23	53	01.39		1	59 49.4	1872.0	5.65	5.91	.488 216	4 233	13 48 30
23	23	57	30.68		1	28 37.4	1874.6	5.67	5.93	.483 983	4 274	13 49 02
24	0	01	59.65		0	57 22.8	1876.6	5.68	5.95	.479 709	4 315	13 49 34
25	0	06	28.33	+	0	26 06.2	+1877.9	5.70	5.96	1.475 394	- 4 357	13 50 06
26	0	10	56.77		0	05 11.7	1878.3	5.72	5.98	.471 037	4 398	13 50 38
27	0	15	25.03		0	36 30.0	1878.2	5.73	6.00	.466 639	4 439	13 51 10
28	0	19	53.14		1	07 48.2	1877.3	5.75	6.02	.462 200	4 481	13 51 41
Mar. 1	0	24	21.15		1	39 05.5	1875.7	5.77	6.04	.457 719	4 522	13 52 13
2	0	28	49.10	+	2	10 21.2	+1873.4	5.79	6.06	1.453 197	- 4 565	13 52 44
3	0	33	17.04		2	41 34.6	1870.3	5.81	6.07	.448 632	4 607	13 53 16
4	0	37	45.02		3	12 44.9	1866.7	5.82	6.09	.444 025	4 650	13 53 47
5	0	42	13.06		3	43 51.6	1862.1	5.84	6.11	.439 375	4 694	13 54 19
6	0	46	41.21		4	14 53.7	1856.9	5.86	6.13	.434 681	4 737	13 54 50
7	0	51	09.52	+	4	45 50.6	+1850.9	5.88	6.15	1.429 944	- 4 781	13 55 22
8	0	55	38.01		5	16 41.5	1844.3	5.90	6.17	.425 163	4 825	13 55 54
9	1	00	06.72		5	47 25.8	1836.8	5.92	6.20	.420 338	4 870	13 56 26
10	1	04	35.70		6	18 02.6	1828.6	5.94	6.22	.415 468	4 915	13 56 59
11	1	09	04.98		6	48 31.2	1819.6	5.96	6.24	.410 553	4 960	13 57 32
12	1	13	34.60	+	7	18 50.8	+1810.0	5.98	6.26	1.405 593	- 5 005	13 58 05
13	1	18	04.59		7	49 00.8	1799.6	6.00	6.28	.400 588	5 051	13 58 39
14	1	22	34.99		8	19 00.4	1788.5	6.03	6.31	.395 537	5 095	13 59 13
15	1	27	05.83		8	48 48.9	1776.5	6.05	6.33	.390 442	5 142	13 59 48
16	1	31	37.15		9	18 25.4	1764.0	6.07	6.35	.385 300	5 186	14 00 23
17	1	36	08.99	+	9	47 49.4	+1750.5	6.09	6.38	1.380 114	- 5 232	14 00 58
18	1	40	41.36		10	16 59.9	1736.4	6.12	6.40	.374 882	5 277	14 01 35
19	1	45	14.30		10	45 56.3	1721.6	6.14	6.43	.369 605	5 323	14 02 11
20	1	49	47.85		11	14 37.9	1705.9	6.16	6.45	.364 282	5 367	14 02 49
21	1	54	22.01		11	43 03.8	1689.6	6.19	6.48	.358 915	5 412	14 03 27
22	1	58	56.83	+	12	11 13.4	+1672.4	6.21	6.50	1.353 503	- 5 457	14 04 05
23	2	03	32.33		12	39 05.8	1654.6	6.24	6.53	.348 046	5 500	14 04 45
24	2	08	08.53		13	06 40.4	1636.0	6.26	6.55	.342 546	5 544	14 05 25
25	2	12	45.46		13	33 56.4	1616.8	6.29	6.58	.337 002	5 588	14 06 06
26	2	17	23.14		14	00 53.2	1596.7	6.32	6.61	.331 414	5 630	14 06 47
27	2	22	01.61	+	14	27 29.9	+1576.1	6.34	6.64	1.325 784	- 5 674	14 07 30
28	2	26	40.88		14	53 46.0	1554.7	6.37	6.67	.320 110	5 716	14 08 13
29	2	31	20.98		15	19 40.7	1532.6	6.40	6.70	.314 394	5 758	14 08 57
30	2	36	01.94		15	45 13.3	1509.9	6.43	6.72	.308 636	5 802	14 09 42
31	2	40	43.76		16	10 23.2	1486.5	6.46	6.75	.302 834	5 844	14 10 28
Apr. 1	2	45	26.47	+	16	35 09.7	+1462.2	6.48	6.78	1.296 990	- 5 887	14 11 14
2	2	50	10.08		16	59 31.9		6.51	6.82	1.291 103		14 12 02

VENUS, 1967

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Apr. 1	2 45 26.47 ^s	+16 35 09.7 ["]	6.48	6.78	1.296 990 - 5 887	14 11 14
2	2 50 10.08 ^s	16 59 31.9 ["]	6.51	6.82	.291 103 5 931	14 12 02
3	2 54 54.59 ^s	17 23 29.4 ["]	6.54	6.85	.285 172 5 973	14 12 51
4	2 59 40.02 ^s	17 47 01.2 ["]	6.57	6.88	.279 199 6 017	14 13 40
5	3 04 26.37 ^s	18 10 06.8 ["]	6.61	6.91	.273 182 6 061	14 14 30
6	3 09 13.64 ^s	+18 32 45.5 ["]	6.64	6.94	1.267 121 - 6 104	14 15 22
7	3 14 01.84 ^s	18 54 56.4 ["]	6.67	6.98	.261 017 6 148	14 16 14
8	3 18 50.97 ^s	19 16 39.1 ["]	6.70	7.01	.254 869 6 191	14 17 07
9	3 23 41.01 ^s	19 37 52.7 ["]	6.74	7.05	.248 678 6 236	14 18 01
10	3 28 31.97 ^s	19 58 36.6 ["]	6.77	7.08	.242 442 6 279	14 18 56
11	3 33 23.84 ^s	+20 18 50.2 ["]	6.80	7.12	1.236 163 - 6 322	14 19 52
12	3 38 16.60 ^s	20 38 32.9 ["]	6.84	7.16	.229 841 6 366	14 20 49
13	3 43 10.23 ^s	20 57 43.8 ["]	6.87	7.19	.223 475 6 409	14 21 47
14	3 48 04.73 ^s	21 16 22.6 ["]	6.91	7.23	.217 066 6 453	14 22 45
15	3 53 00.06 ^s	21 34 28.5 ["]	6.95	7.27	.210 613 6 495	14 23 44
16	3 57 56.20 ^s	+21 52 00.9 ["]	6.98	7.31	1.204 118 - 6 538	14 24 44
17	4 02 53.12 ^s	22 08 59.4 ["]	7.02	7.35	.197 580 6 580	14 25 45
18	4 07 50.80 ^s	22 25 23.2 ["]	7.06	7.39	.191 000 6 621	14 26 47
19	4 12 49.19 ^s	22 41 11.9 ["]	7.10	7.43	.184 379 6 663	14 27 49
20	4 17 48.26 ^s	22 56 24.9 ["]	7.14	7.47	.177 716 6 704	14 28 52
21	4 22 47.97 ^s	+23 11 01.7 ["]	7.18	7.51	1.171 012 - 6 743	14 29 56
22	4 27 48.29 ^s	23 25 01.9 ["]	7.22	7.56	.164 269 6 782	14 31 00
23	4 32 49.17 ^s	23 38 24.9 ["]	7.27	7.60	.157 487 6 822	14 32 04
24	4 37 50.58 ^s	23 51 10.4 ["]	7.31	7.65	.150 665 6 859	14 33 10
25	4 42 52.47 ^s	24 03 17.9 ["]	7.35	7.69	.143 806 6 896	14 34 15
26	4 47 54.80 ^s	+24 14 47.2 ["]	7.40	7.74	1.136 910 - 6 933	14 35 21
27	4 52 57.53 ^s	24 25 37.8 ["]	7.44	7.79	.129 977 6 969	14 36 28
28	4 58 00.61 ^s	24 35 49.5 ["]	7.49	7.84	.123 008 7 006	14 37 35
29	5 03 03.97 ^s	24 45 21.9 ["]	7.54	7.89	.116 002 7 042	14 38 42
30	5 08 07.57 ^s	24 54 14.8 ["]	7.58	7.94	.108 960 7 077	14 39 49
May 1	5 13 11.36 ^s	+25 02 28.0 ["]	7.63	7.99	1.101 883 - 7 112	14 40 56
2	5 18 15.27 ^s	25 10 01.1 ["]	7.68	8.04	.094 771 7 147	14 42 04
3	5 23 19.23 ^s	25 16 54.0 ["]	7.73	8.09	.087 624 7 183	14 43 11
4	5 28 23.19 ^s	25 23 06.5 ["]	7.78	8.14	.080 441 7 217	14 44 18
5	5 33 27.10 ^s	25 28 38.5 ["]	7.84	8.20	.073 224 7 252	14 45 26
6	5 38 30.86 ^s	+25 33 29.8 ["]	7.89	8.26	1.065 972 - 7 286	14 46 33
7	5 43 34.43 ^s	25 37 40.3 ["]	7.94	8.31	.058 686 7 320	14 47 40
8	5 48 37.73 ^s	25 41 10.1 ["]	8.00	8.37	.051 366 7 354	14 48 47
9	5 53 40.70 ^s	25 43 59.0 ["]	8.06	8.43	.044 012 7 386	14 49 53
10	5 58 43.25 ^s	25 46 07.1 ["]	8.11	8.49	.036 626 7 420	14 50 59
11	6 03 45.32 ^s	+25 47 34.5 ["]	8.17	8.55	1.029 206 - 7 453	14 52 04
12	6 08 46.83 ^s	25 48 21.1 ["]	8.23	8.61	.021 753 7 485	14 53 08
13	6 13 47.70 ^s	25 48 27.2 ["]	8.29	8.68	.014 268 7 516	14 54 12
14	6 18 47.86 ^s	25 47 52.9 ["]	8.35	8.74	1.006 752 7 547	14 55 15
15	6 23 47.23 ^s	25 46 38.3 ["]	8.42	8.81	0.999 205 7 578	14 56 18
16	6 28 45.72 ^s	+25 44 43.7 ["]	8.48	8.87	0.991 627 - 7 608	14 57 19
17	6 33 43.27 ^s	25 42 09.3 ["]	8.55	8.94	0.984 019	14 58 20

VENUS, 1967
FOR 0^h EPHEMERIS TIME

189

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
May 17	6 33 43.27 ^s	+25 42 09.3	8.55	8.94	0.984 019	14 58 20
18	6 38 39.80 ^{+296.53}	25 38 55.3	8.61	9.01	.976 382	14 59 19
19	6 43 35.23 ^{295.43}	25 35 02.1	8.68	9.08	.968 717	15 00 17
20	6 48 29.48 ^{294.25}	25 30 30.0	8.75	9.16	.961 025	15 01 14
21	6 53 22.50 ^{293.02}	25 25 19.4	8.82	9.23	.953 307	15 02 10
	^{291.72}		^{348.9}		^{7 744}	
22	6 58 14.22	+25 19 30.5	8.89	9.31	0.945 563	15 03 04
23	7 03 04.56 ^{+290.34}	25 13 04.0	8.97	9.38	.937 795	15 03 57
24	7 07 53.46 ^{288.90}	25 06 00.2	9.04	9.46	.930 004	15 04 48
25	7 12 40.87 ^{287.41}	24 58 19.6	9.12	9.54	.922 190	15 05 38
26	7 17 26.73 ^{285.86}	24 50 02.8	9.20	9.62	.914 356	15 06 27
	^{284.24}		^{532.6}		^{7 856}	
27	7 22 10.97	+24 41 10.2	9.28	9.71	0.906 500	15 07 13
28	7 26 53.54 ^{+282.57}	24 31 42.3	9.36	9.79	.898 625	15 07 58
29	7 31 34.37 ^{280.83}	24 21 39.7	9.44	9.88	.890 731	15 08 42
30	7 36 13.43 ^{279.06}	24 11 03.0	9.53	9.97	.882 818	15 09 23
31	7 40 50.66 ^{277.23}	23 59 52.8	9.61	10.06	.874 887	15 10 02
	^{275.34}		^{703.2}		^{7 948}	
June 1	7 45 26.00	+23 48 09.6	9.70	10.15	0.866 939	15 10 40
2	7 49 59.41 ^{+273.41}	23 35 54.0	9.79	10.24	.858 974	15 11 16
3	7 54 30.84 ^{271.43}	23 23 06.8	9.88	10.34	.850 993	15 11 49
4	7 59 00.23 ^{269.39}	23 09 48.5	9.98	10.44	.842 997	15 12 21
5	8 03 27.54 ^{267.31}	22 55 59.8	10.07	10.54	.834 986	15 12 50
	^{265.20}		^{858.4}		^{8 026}	
6	8 07 52.74	+22 41 41.4	10.17	10.64	0.826 960	15 13 17
7	8 12 15.75 ^{+263.01}	22 26 54.0	10.27	10.75	.818 921	15 13 42
8	8 16 36.55 ^{260.80}	22 11 38.4	10.37	10.85	.810 869	15 14 05
9	8 20 55.08 ^{258.53}	21 55 55.2	10.48	10.96	.802 805	15 14 26
10	8 25 11.30 ^{256.22}	21 39 45.2	10.58	11.07	.794 729	15 14 44
	^{253.86}		^{995.9}		^{8 087}	
11	8 29 25.16	+21 23 09.3	10.69	11.19	0.786 642	15 15 00
12	8 33 36.61 ^{+251.45}	21 06 08.2	10.80	11.30	.778 545	15 15 13
13	8 37 45.60 ^{248.99}	20 48 42.6	10.92	11.42	.770 439	15 15 24
14	8 41 52.10 ^{246.50}	20 30 53.3	11.03	11.54	.762 325	15 15 32
15	8 45 56.03 ^{243.93}	20 12 41.3	11.15	11.67	.754 205	15 15 38
	^{241.35}		^{1114.0}		^{8 127}	
16	8 49 57.38	+19 54 07.3	11.27	11.80	0.746 078	15 15 41
17	8 53 56.09 ^{+238.71}	19 35 12.2	11.40	11.92	.737 947	15 15 42
18	8 57 52.11 ^{236.02}	19 15 56.8	11.52	12.06	.729 813	15 15 39
19	9 01 45.42 ^{233.31}	18 56 21.9	11.65	12.19	.721 677	15 15 34
20	9 05 35.96 ^{230.54}	18 36 28.4	11.79	12.33	.713 541	15 15 26
	^{227.74}		^{1211.2}		^{8 135}	
21	9 09 23.70	+18 16 17.2	11.92	12.48	0.705 406	15 15 16
22	9 13 08.60 ^{+224.90}	17 55 49.1	12.06	12.62	.697 275	15 15 02
23	9 16 50.61 ^{222.01}	17 35 05.1	12.20	12.77	.689 147	15 14 46
24	9 20 29.70 ^{219.09}	17 14 05.8	12.35	12.92	.681 026	15 14 27
25	9 24 05.82 ^{216.12}	16 52 52.3	12.50	13.08	.672 912	15 14 04
	^{213.11}		^{1286.9}		^{8 106}	
26	9 27 38.93	+16 31 25.4	12.65	13.24	0.664 806	15 13 39
27	9 31 09.00 ^{+210.07}	16 09 45.8	12.81	13.40	.656 711	15 13 10
28	9 34 35.97 ^{206.97}	15 47 54.6	12.97	13.57	.648 626	15 12 39
29	9 37 59.80 ^{203.83}	15 25 52.3	13.13	13.74	.640 555	15 12 04
30	9 41 20.44 ^{200.64}	15 03 40.2	13.30	13.91	.632 497	15 11 26
	^{197.41}		^{1341.2}		^{8 042}	
July 1	9 44 37.85	+14 41 19.0	13.47	14.09	0.624 455	15 10 45
2	9 47 51.96 ^{+194.11}	+14 18 49.4	13.64	14.28	0.616 429	15 10 01

VENUS, 1967 FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
July 1	9 44 37.85	+14 41 19.0	13.47	14.09	0.624 455	15 10 45
2	9 47 51.96	14 18 49.4	13.64	14.28	0.616 429	15 10 01
3	9 51 02.71	13 56 12.6	13.82	14.46	0.608 421	15 09 13
4	9 54 10.04	13 33 29.5	14.01	14.66	0.600 433	15 08 21
5	9 57 13.89	13 10 40.9	14.19	14.85	0.592 466	15 07 26
6	10 00 14.17	+12 47 47.8	14.39	15.06	0.584 522	15 06 28
7	10 03 10.82	12 24 51.3	14.59	15.26	0.576 601	15 05 26
8	10 06 03.75	12 01 52.3	14.79	15.47	0.568 707	15 04 20
9	10 08 52.88	11 38 51.9	15.00	15.69	0.560 840	15 03 10
10	10 11 38.00	11 15 51.2	15.21	15.91	0.553 003	15 01 56
11	10 14 19.29	+10 52 51.3	15.43	16.14	0.545 197	15 00 38
12	10 16 56.37	10 29 53.1	15.65	16.37	0.537 424	14 59 16
13	10 19 29.21	10 06 58.1	15.88	16.61	0.529 688	14 57 50
14	10 21 57.72	9 44 07.3	16.11	16.86	0.521 990	14 56 19
15	10 24 21.75	9 21 21.9	16.35	17.11	0.514 333	14 54 44
16	10 26 41.18	+ 8 58 43.3	16.60	17.37	0.506 721	14 53 04
17	10 28 55.88	8 36 12.6	16.85	17.63	0.499 156	14 51 19
18	10 31 05.71	8 13 51.3	17.11	17.90	0.491 641	14 49 29
19	10 33 10.54	7 51 40.6	17.37	18.18	0.484 180	14 47 35
20	10 35 10.21	7 29 42.0	17.64	18.46	0.476 777	14 45 35
21	10 37 04.57	+ 7 07 56.8	17.92	18.75	0.469 435	14 43 29
22	10 38 53.47	6 46 26.5	18.20	19.04	0.462 157	14 41 19
23	10 40 36.76	6 25 12.6	18.49	19.34	0.454 948	14 39 02
24	10 42 14.26	6 04 16.6	18.78	19.65	0.447 812	14 36 40
25	10 43 45.82	5 43 39.9	19.08	19.97	0.440 752	14 34 11
26	10 45 11.26	+ 5 23 24.3	19.39	20.29	0.433 773	14 31 36
27	10 46 30.42	5 03 31.4	19.70	20.61	0.426 880	14 28 55
28	10 47 43.10	4 44 02.9	20.02	20.95	0.420 075	14 26 08
29	10 48 49.15	4 25 00.5	20.35	21.29	0.413 365	14 23 14
30	10 49 48.35	4 06 26.1	20.68	21.63	0.406 754	14 20 13
31	10 50 40.55	+ 3 48 21.8	21.01	21.99	0.400 246	14 17 04
Aug. 1	10 51 25.55	3 30 49.4	21.35	22.34	0.393 848	14 13 49
2	10 52 03.16	3 13 51.0	21.70	22.71	0.387 564	14 10 26
3	10 52 33.20	2 57 28.8	22.05	23.07	0.381 400	14 06 55
4	10 52 55.50	2 41 44.8	22.41	23.44	0.375 362	14 03 17
5	10 53 09.89	+ 2 26 41.6	22.76	23.82	0.369 456	13 59 31
6	10 53 16.20	2 12 21.3	23.12	24.20	0.363 689	13 55 36
7	10 53 14.29	1 58 46.4	23.49	24.58	0.358 066	13 51 34
8	10 53 04.01	1 45 59.3	23.85	24.96	0.352 595	13 47 23
9	10 52 45.26	1 34 02.6	24.22	25.34	0.347 283	13 43 03
10	10 52 17.94	+ 1 22 58.7	24.58	25.72	0.342 137	13 38 35
11	10 51 41.99	1 12 50.2	24.94	26.10	0.337 166	13 33 59
12	10 50 57.39	1 03 39.4	25.30	26.48	0.332 377	13 29 14
13	10 50 04.16	0 55 28.8	25.66	26.85	0.327 779	13 24 20
14	10 49 02.37	0 48 20.6	26.01	27.21	0.323 380	13 19 18
15	10 47 52.12	+ 0 42 16.9	26.35	27.57	0.319 188	13 14 08
16	10 46 33.58	+ 0 37 19.7	26.68	27.92	0.315 213	13 08 50

VENUS, 1967

FOR 0^h EPHEMERIS TIME

191

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]				^h ^m ^s
Aug. 16	10 46 33.58 - 86.57	+ 0 37 19.7 - 229.3	26.68	27.92	0.315 213 - 3 750	13 08 50
17	10 45 07.01 94.34	0 33 30.4 159.8	27.00	28.25	.311 463 3 518	13 03 23
18	10 43 32.67 101.72	0 30 50.6 89.2	27.31	28.58	.307 945 3 276	12 57 50
19	10 41 50.95 108.70	0 29 21.4 - 18.4	27.60	28.88	.304 669 3 028	12 52 09
20	10 40 02.25 115.15	0 29 03.0 + 52.9	27.88	29.17	.301 641 2 771	12 46 22
21	10 38 07.10 - 121.06	+ 0 29 55.9 + 124.0	28.14	29.44	0.298 870 - 2 508	12 40 28
22	10 36 06.04 126.33	0 31 59.9 194.3	28.38	29.69	.296 362 2 239	12 34 29
23	10 33 59.71 130.93	0 35 14.2 263.4	28.59	29.92	.294 123 1 964	12 28 25
24	10 31 48.78 134.77	0 39 37.6 330.7	28.79	30.12	.292 159 1 684	12 22 17
25	10 29 34.01 137.84	0 45 08.3 395.9	28.95	30.30	.290 475 1 400	12 16 06
26	10 27 16.17 - 140.08	+ 0 51 44.2 + 458.4	29.09	30.44	0.289 075 - 1 113	12 09 52
27	10 24 56.09 141.47	0 59 22.6 517.7	29.21	30.56	.287 962 822	12 03 36
28	10 22 34.62 141.98	1 08 00.3 573.2	29.29	30.65	.287 140 531	11 57 19
29	10 20 12.64 141.60	1 17 33.5 625.0	29.34	30.70	.286 609 - 239	11 51 03
30	10 17 51.04 140.35	1 27 58.5 672.0	29.37	30.73	.286 370 + 54	11 44 47
31	10 15 30.69 - 138.20	+ 1 39 10.5 + 714.4	29.36	30.72	0.286 424 + 345	11 38 32
Sept. 1	10 13 12.49 135.23	1 51 04.9 751.8	29.33	30.69	.286 769 633	11 32 20
2	10 10 57.26 131.44	2 03 36.7 784.3	29.26	30.62	.287 402 920	11 26 12
3	10 08 45.82 126.87	2 16 41.0 811.4	29.17	30.52	.288 322 1 202	11 20 08
4	10 06 38.95 121.58	2 30 12.4 833.2	29.05	30.39	.289 524 1 480	11 14 08
5	10 04 37.37 - 115.60	+ 2 44 05.6 + 849.7	28.90	30.24	0.291 004 + 1 753	11 08 14
6	10 02 41.77 109.00	2 58 15.3 861.3	28.73	30.06	.292 757 2 022	11 02 26
7	10 00 52.77 101.86	3 12 36.6 867.7	28.53	29.85	.294 779 2 283	10 56 45
8	9 59 10.91 94.21	3 27 04.3 869.0	28.31	29.62	.297 062 2 539	10 51 12
9	9 57 36.70 86.11	3 41 33.3 866.1	28.07	29.37	.299 601 2 788	10 45 46
10	9 56 10.59 - 77.63	+ 3 55 59.4 + 858.4	27.81	29.10	0.302 389 + 3 029	10 40 28
11	9 54 52.96 68.84	4 10 17.8 846.3	27.54	28.81	.305 418 3 263	10 35 19
12	9 53 44.12 59.81	4 24 24.1 830.7	27.24	28.51	.308 681 3 490	10 30 18
13	9 52 44.31 50.57	4 38 14.8 811.1	26.94	28.19	.312 171 3 709	10 25 27
14	9 51 53.74 41.18	4 51 45.9 788.2	26.62	27.86	.315 880 3 918	10 20 45
15	9 51 12.56 - 31.71	+ 5 04 54.1 + 762.1	26.30	27.52	0.319 798 + 4 121	10 16 12
16	9 50 40.85 22.21	5 17 36.2 733.2	25.96	27.17	.323 919 4 314	10 11 49
17	9 50 18.64 12.71	5 29 49.4 701.8	25.62	26.81	.328 233 4 500	10 07 34
18	9 50 05.93 - 3.25	5 41 31.2 668.2	25.28	26.45	.332 733 4 676	10 03 30
19	9 50 02.68 + 6.09	5 52 39.4 632.5	24.93	26.08	.337 409 4 846	9 59 35
20	9 50 08.77 + 15.35	+ 6 03 11.9 + 595.2	24.57	25.71	0.342 255 + 5 006	9 55 49
21	9 50 24.12 24.44	6 13 07.1 556.5	24.22	25.34	.347 261 5 160	9 52 12
22	9 50 48.56 33.35	6 22 23.6 516.5	23.86	24.97	.352 421 5 305	9 48 44
23	9 51 21.91 42.07	6 31 00.1 475.5	23.51	24.60	.357 726 5 442	9 45 25
24	9 52 03.98 50.57	6 38 55.6 433.7	23.16	24.23	.363 168 5 574	9 42 14
25	9 52 54.55 + 58.84	+ 6 46 09.3 + 391.3	22.81	23.86	0.368 742 + 5 696	9 39 12
26	9 53 53.39 66.88	6 52 40.6 348.4	22.46	23.50	.374 438 5 814	9 36 18
27	9 55 00.27 74.65	6 58 29.0 305.2	22.12	23.14	.380 252 5 925	9 33 32
28	9 56 14.92 82.19	7 03 34.2 261.8	21.78	22.79	.386 177 6 028	9 30 53
29	9 57 37.11 89.45	7 07 56.0 218.4	21.44	22.44	.392 205 6 128	9 28 22
30	9 59 06.56 + 96.46	+ 7 11 34.4 + 174.7	21.11	22.09	0.398 333 + 6 220	9 25 58
Oct. 1	10 00 43.02	+ 7 14 29.1	20.79	21.75	0.404 553	9 23 41

VENUS, 1967

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	h m s	° ' "	"	"		h m s
Oct. 1	10 00 43.02	+ 7 14 29.1	20.79	21.75	0.404 553	9 23 41
2	10 02 26.21	7 16 40.7	20.47	21.42	0.410 861	9 21 30
3	10 04 15.89	7 18 09.0	20.16	21.09	0.417 252	9 19 26
4	10 06 11.79	7 18 54.6	19.85	20.77	0.423 722	9 17 28
5	10 08 13.67	7 18 57.6	19.55	20.45	0.430 265	9 15 35
6	10 10 21.29	+ 7 18 18.5	19.25	20.14	0.436 879	9 13 49
7	10 12 34.41	7 16 57.6	18.96	19.84	0.443 559	9 12 07
8	10 14 52.81	7 14 55.3	18.68	19.54	0.450 302	9 10 31
9	10 17 16.27	7 12 12.3	18.40	19.25	0.457 106	9 09 00
10	10 19 44.58	7 08 48.8	18.13	18.97	0.463 966	9 07 34
11	10 22 17.55	+ 7 04 45.2	17.86	18.69	0.470 880	9 06 12
12	10 24 54.98	7 00 02.2	17.60	18.42	0.477 845	9 04 55
13	10 27 36.68	6 54 40.2	17.35	18.15	0.484 858	9 03 41
14	10 30 22.48	6 48 39.6	17.10	17.89	0.491 917	9 02 32
15	10 33 12.20	6 42 01.0	16.85	17.63	0.499 018	9 01 27
16	10 36 05.70	+ 6 34 44.9	16.62	17.39	0.506 159	9 00 25
17	10 39 02.79	6 26 51.9	16.38	17.14	0.513 337	8 59 27
18	10 42 03.34	6 18 22.4	16.16	16.91	0.520 551	8 58 32
19	10 45 07.19	6 09 17.1	15.93	16.67	0.527 797	8 57 41
20	10 48 14.20	5 59 36.7	15.72	16.45	0.535 074	8 56 53
21	10 51 24.25	+ 5 49 21.7	15.51	16.22	0.542 378	8 56 07
22	10 54 37.19	5 38 32.9	15.30	16.01	0.549 709	8 55 25
23	10 57 52.90	5 27 10.9	15.10	15.80	0.557 063	8 54 45
24	11 01 11.25	5 15 16.3	14.90	15.59	0.564 440	8 54 07
25	11 04 32.15	5 02 50.0	14.71	15.39	0.571 836	8 53 33
26	11 07 55.46	+ 4 49 52.6	14.52	15.19	0.579 250	8 53 00
27	11 11 21.09	4 36 24.8	14.33	15.00	0.586 680	8 52 30
28	11 14 48.93	4 22 27.5	14.16	14.81	0.594 125	8 52 02
29	11 18 18.89	4 08 01.4	13.98	14.63	0.601 582	8 51 37
30	11 21 50.88	3 53 07.3	13.81	14.45	0.609 051	8 51 13
31	11 25 24.79	+ 3 37 46.0	13.64	14.27	0.616 530	8 50 51
Nov. 1	11 29 00.57	3 21 58.3	13.48	14.10	0.624 017	8 50 31
2	11 32 38.12	3 05 45.1	13.32	13.93	0.631 512	8 50 12
3	11 36 17.38	2 49 07.0	13.16	13.77	0.639 014	8 49 56
4	11 39 58.28	2 32 04.9	13.01	13.61	0.646 521	8 49 41
5	11 43 40.76	+ 2 14 39.7	12.86	13.45	0.654 034	8 49 27
6	11 47 24.76	1 56 52.1	12.71	13.30	0.661 551	8 49 15
7	11 51 10.24	1 38 43.0	12.57	13.15	0.669 072	8 49 04
8	11 54 57.14	1 20 12.9	12.43	13.01	0.676 595	8 48 55
9	11 58 45.43	1 01 22.9	12.29	12.86	0.684 122	8 48 48
10	12 02 35.07	+ 0 42 13.5	12.16	12.72	0.691 650	8 48 41
11	12 06 26.03	0 22 45.6	12.03	12.59	0.699 179	8 48 36
12	12 10 18.28	+ 0 02 59.8	11.90	12.45	0.706 708	8 48 32
13	12 14 11.80	0 17 03.1	11.77	12.32	0.714 237	8 48 30
14	12 18 06.57	0 37 22.2	11.65	12.19	0.721 765	8 48 28
15	12 22 02.55	- 0 57 56.9	11.53	12.07	0.729 290	8 48 28
16	12 25 59.75	- 1 18 46.3	11.41	11.94	0.736 812	8 48 29

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit	
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s	
Nov. 16	12 25 59.75 ^s	+238.38 ^s	— 1 18 46.3	11.41	11.94	0.736 812	8 48 29
17	12 29 58.13	239.56	1 39 49.7	11.30	11.82	.744 330 + 7 518	8 48 31
18	12 33 57.69	240.72	2 01 06.3	11.19	11.70	.751 844 7 514	8 48 35
19	12 37 58.41	241.87	2 22 35.3	11.08	11.59	.759 352 7 508	8 48 40
20	12 42 00.28	243.00	2 44 15.9	10.97	11.48	.766 853 7 501	8 48 45
			1311.3			7 494	
21	12 46 03.28	+244.14	— 3 06 07.2	10.86	11.36	0.774 347 + 7 486	8 48 52
22	12 50 07.42	245.26	3 28 08.5	10.76	11.26	.781 833 7 477	8 49 00
23	12 54 12.68	246.37	3 50 18.9	10.65	11.15	.789 310 7 467	8 49 09
24	12 58 19.05	247.49	4 12 37.6	10.56	11.04	.796 777 7 456	8 49 19
25	13 02 26.54	248.59	4 35 03.7	10.46	10.94	.804 233 7 444	8 49 31
			1352.6				
26	13 06 35.13	+249.68	— 4 57 36.3	10.36	10.84	0.811 677 + 7 432	8 49 43
27	13 10 44.81	250.79	5 20 14.7	10.27	10.74	.819 109 7 419	8 49 57
28	13 14 55.60	251.89	5 42 57.9	10.18	10.65	.826 528 7 405	8 50 11
29	13 19 07.49	252.98	6 05 45.0	10.08	10.55	.833 933 7 390	8 50 27
30	13 23 20.47	254.09	6 28 35.2	10.00	10.46	.841 323 7 376	8 50 44
			1372.4				
Dec. 1	13 27 34.56	+255.18	— 6 51 27.6	9.91	10.37	0.848 699 + 7 361	8 51 02
2	13 31 49.74	256.28	7 14 21.5	9.82	10.28	.856 060 7 346	8 51 21
3	13 36 06.02	257.39	7 37 15.7	9.74	10.19	.863 406 7 330	8 51 41
4	13 40 23.41	258.49	8 00 09.7	9.66	10.11	.870 736 7 315	8 52 02
5	13 44 41.90	259.60	8 23 02.4	9.58	10.02	.878 051 7 299	8 52 25
			1370.6				
6	13 49 01.50	+260.73	— 8 45 53.0	9.50	9.94	0.885 350 + 7 283	8 52 48
7	13 53 22.23	261.87	9 08 40.7	9.42	9.86	.892 633 7 268	8 53 13
8	13 57 44.10	263.01	9 31 24.7	9.35	9.78	.899 901 7 251	8 53 38
9	14 02 07.11	264.18	9 54 04.2	9.27	9.70	.907 152 7 236	8 54 05
10	14 06 31.29	265.36	10 16 38.2	9.20	9.62	.914 388 7 218	8 54 33
			1347.9				
11	14 10 56.65	+266.54	— 10 39 06.1	9.13	9.55	0.921 606 + 7 202	8 55 03
12	14 15 23.19	267.75	11 01 27.1	9.05	9.47	.928 808 7 184	8 55 33
13	14 19 50.94	268.97	11 23 40.2	8.99	9.40	.935 992 7 166	8 56 05
14	14 24 19.91	270.20	11 45 44.7	8.92	9.33	.943 158 7 149	8 56 38
15	14 28 50.11	271.44	12 07 39.7	8.85	9.26	.950 307 7 130	8 57 12
			1304.8				
16	14 33 21.55	+272.70	— 12 29 24.5	8.78	9.19	0.957 437 + 7 112	8 57 47
17	14 37 54.25	273.95	12 50 58.1	8.72	9.12	.964 549 7 092	8 58 24
18	14 42 28.20	275.23	13 12 19.8	8.66	9.06	.971 641 7 072	8 59 02
19	14 47 03.43	276.51	13 33 28.7	8.59	8.99	.978 713 7 052	8 59 41
20	14 51 39.94	277.80	13 54 24.0	8.53	8.93	.985 765 7 031	9 00 21
			1240.8				
21	14 56 17.74	+279.09	— 14 15 04.8	8.47	8.86	0.992 796 + 7 010	9 01 03
22	15 00 56.83	280.38	14 35 30.3	8.41	8.80	.999 806 6 987	9 01 46
23	15 05 37.21	281.68	14 55 39.6	8.35	8.74	1.006 793 6 965	9 02 30
24	15 10 18.89	282.99	15 15 31.9	8.30	8.68	.013 758 6 942	9 03 16
25	15 15 01.88	284.29	15 35 06.3	8.24	8.62	.020 700 6 918	9 04 03
			1155.7				
26	15 19 46.17	+285.60	— 15 54 22.0	8.18	8.56	1.027 618 + 6 894	9 04 51
27	15 24 31.77	286.89	16 13 18.2	8.13	8.51	.034 512 6 869	9 05 41
28	15 29 18.66	288.17	16 31 54.0	8.08	8.45	.041 381 6 844	9 06 32
29	15 34 06.83	289.46	16 50 08.6	8.02	8.40	.048 225 6 820	9 07 24
30	15 38 56.29	290.73	17 08 01.2	7.97	8.34	.055 045 6 794	9 08 17
			1049.7				
31	15 43 47.02	+291.97	— 17 25 30.9	7.92	8.29	1.061 839 + 6 768	9 09 12
32	15 48 38.99		— 17 42 37.1	7.87	8.24	1.068 607	9 10 08
			1026.2				

MARS, 1967

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Jan. 0	12 53 25.08 +104.82	- 3 30 00.3 - 623.2	3.27	6.16	1.429 398	6 16 58
1	12 55 09.90 104.18	3 40 23.5 617.4	3.30	6.20	.419 397	6 14 46
2	12 56 54.08 103.51	3 50 40.9 611.7	3.32	6.24	.409 380	6 12 33
3	12 58 37.59 102.84	4 00 52.6 605.7	3.34	6.29	.399 349	6 10 20
4	13 00 20.43 102.14	4 10 58.3 599.8	3.37	6.33	.389 304	6 08 07
5	13 02 02.57 +101.42	- 4 20 58.1 - 593.6	3.39	6.38	1.379 245	6 05 52
6	13 03 43.99 100.70	4 30 51.7 587.3	3.42	6.43	.369 174	6 03 37
7	13 05 24.69 99.94	4 40 39.0 581.0	3.44	6.47	.359 093	6 01 21
8	13 07 04.63 99.17	4 50 20.0 574.4	3.47	6.52	.349 003	5 59 05
9	13 08 43.80 98.38	4 59 54.4 567.7	3.50	6.57	.338 904	5 56 48
10	13 10 22.18 + 97.56	- 5 09 22.1 - 561.1	3.52	6.62	1.328 799	5 54 29
11	13 11 59.74 96.73	5 18 43.2 554.1	3.55	6.67	.318 689	5 52 10
12	13 13 36.47 95.88	5 27 57.3 547.2	3.58	6.72	.308 576	5 49 51
13	13 15 12.35 95.01	5 37 04.5 540.1	3.60	6.78	.298 460	5 47 30
14	13 16 47.36 94.11	5 46 04.6 533.0	3.63	6.83	.288 344	5 45 08
15	13 18 21.47 + 93.21	- 5 54 57.6 - 525.7	3.66	6.88	1.278 229	5 42 46
16	13 19 54.68 92.28	6 03 43.3 518.3	3.69	6.94	.268 117	5 40 23
17	13 21 26.96 91.34	6 12 21.6 511.0	3.72	7.00	.258 008	5 37 58
18	13 22 58.30 90.37	6 20 52.6 503.5	3.75	7.05	.247 904	5 35 33
19	13 24 28.67 89.38	6 29 16.1 495.8	3.78	7.11	.237 806	5 33 07
20	13 25 58.05 + 88.37	- 6 37 31.9 - 488.3	3.81	7.17	1.227 717	5 30 40
21	13 27 26.42 87.35	6 45 40.2 480.5	3.84	7.23	.217 636	5 28 12
22	13 28 53.77 86.29	6 53 40.7 472.7	3.88	7.29	.207 566	5 25 42
23	13 30 20.06 85.22	7 01 33.4 464.8	3.91	7.35	.197 507	5 23 12
24	13 31 45.28 84.11	7 09 18.2 456.8	3.94	7.41	.187 461	5 20 41
25	13 33 09.39 + 82.99	- 7 16 55.0 - 448.7	3.97	7.47	1.177 429	5 18 08
26	13 34 32.38 81.82	7 24 23.7 440.6	4.01	7.54	.167 412	5 15 35
27	13 35 54.20 80.63	7 31 44.3 432.2	4.04	7.60	.157 411	5 13 00
28	13 37 14.83 79.42	7 38 56.5 423.7	4.08	7.67	.147 427	5 10 24
29	13 38 34.25 78.16	7 46 00.2 415.1	4.11	7.74	.137 461	5 07 47
30	13 39 52.41 + 76.87	- 7 52 55.3 - 406.4	4.15	7.80	1.127 515	5 05 09
31	13 41 09.28 75.54	7 59 41.7 397.6	4.19	7.87	.117 589	5 02 29
Feb. 1	13 42 24.82 74.19	8 06 19.3 388.6	4.23	7.94	.107 686	4 59 48
2	13 43 39.01 72.80	8 12 47.9 379.4	4.26	8.02	.097 807	4 57 06
3	13 44 51.81 71.35	8 19 07.3 370.2	4.30	8.09	.087 954	4 54 22
4	13 46 03.16 + 69.89	- 8 25 17.5 - 360.8	4.34	8.16	1.078 128	4 51 37
5	13 47 13.05 68.36	8 31 18.3 351.3	4.38	8.24	.068 332	4 48 50
6	13 48 21.41 66.81	8 37 09.6 341.6	4.42	8.31	.058 568	4 46 02
7	13 49 28.22 65.21	8 42 51.2 331.8	4.46	8.39	.048 837	4 43 12
8	13 50 33.43 63.57	8 48 23.0 321.8	4.50	8.47	.039 143	4 40 21
9	13 51 37.00 + 61.90	- 8 53 44.8 - 311.9	4.55	8.55	1.029 486	4 37 28
10	13 52 38.90 60.18	8 58 56.7 301.6	4.59	8.63	.019 869	4 34 33
11	13 53 39.08 58.43	9 03 58.3 291.4	4.63	8.71	.010 296	4 31 37
12	13 54 37.51 56.64	9 08 49.7 281.1	4.68	8.79	1.000 767	4 28 39
13	13 55 34.15 54.82	9 13 30.8 270.6	4.72	8.88	0.991 286	4 25 39
14	13 56 28.97 + 52.94	- 9 18 01.4 - 260.0	4.77	8.96	0.981 853	4 22 37
15	13 57 21.91	- 9 22 21.4	4.81	9.05	0.972 472	4 19 34

MARS, 1967

FOR 0^h EPHEMERIS TIME

195

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Feb. 15	13 57 21.91 + 51.04	- 9 22 21.4 - 249.4	4.81	9.05	0.972 472 - 9 327	4 19 34
16	13 58 12.95 + 49.09	9 26 30.8 - 238.8	4.86	9.14	.963 145 9 272	4 16 28
17	13 59 02.04 + 47.10	9 30 29.6 - 227.9	4.91	9.23	.953 873 9 213	4 13 21
18	13 59 49.14 + 45.08	9 34 17.5 - 216.9	4.95	9.32	.944 660 9 153	4 10 12
19	14 00 34.22 + 43.01	9 37 54.4 - 206.1	5.00	9.41	.935 507 9 091	4 07 00
20	14 01 17.23 + 40.90	- 9 41 20.5 - 194.8	5.05	9.50	0.926 416 - 9 026	4 03 47
21	14 01 58.13 + 38.75	9 44 35.3 - 183.7	5.10	9.59	.917 390 8 960	4 00 31
22	14 02 36.88 + 36.55	9 47 39.0 - 172.4	5.15	9.69	.908 430 8 891	3 57 13
23	14 03 13.43 + 34.30	9 50 31.4 - 160.8	5.20	9.78	.899 539 8 820	3 53 54
24	14 03 47.73 + 32.02	9 53 12.2 - 149.3	5.25	9.88	.890 719 8 747	3 50 31
25	14 04 19.75 + 29.68	- 9 55 41.5 - 137.6	5.31	9.98	0.881 972 - 8 673	3 47 07
26	14 04 49.43 + 27.29	9 57 59.1 - 125.7	5.36	10.08	.873 299 8 595	3 43 40
27	14 05 16.72 + 24.85	10 00 04.8 - 113.6	5.41	10.18	.864 704 8 515	3 40 11
28	14 05 41.57 + 22.38	10 01 58.4 - 101.4	5.47	10.28	.856 189 8 433	3 36 40
Mar. 1	14 06 03.95 + 19.84	10 03 39.8 - 89.1	5.52	10.38	.847 756 8 347	3 33 06
2	14 06 23.79 + 17.26	- 10 05 08.9 - 76.6	5.58	10.48	0.839 409 - 8 259	3 29 29
3	14 06 41.05 + 14.62	10 06 25.5 - 63.9	5.63	10.59	.831 150 8 168	3 25 50
4	14 06 55.67 + 11.94	10 07 29.4 - 51.1	5.69	10.69	.822 982 8 073	3 22 08
5	14 07 07.61 + 9.21	10 08 20.5 - 38.2	5.74	10.80	.814 909 7 976	3 18 24
6	14 07 16.82 + 6.45	10 08 58.7 - 25.2	5.80	10.91	.806 933 7 874	3 14 37
7	14 07 23.27 + 3.63	- 10 09 23.9 - 12.0	5.86	11.01	0.799 059 - 7 769	3 10 47
8	14 07 26.90 + 0.80	10 09 35.9 + 1.3	5.91	11.12	.791 290 7 661	3 06 54
9	14 07 27.70 - 2.08	10 09 34.6 + 14.6	5.97	11.23	.783 629 7 550	3 02 59
10	14 07 25.62 - 4.99	10 09 20.0 + 28.0	6.03	11.34	.776 079 7 434	2 59 00
11	14 07 20.63 - 7.92	10 08 52.0 + 41.4	6.09	11.45	.768 645 7 316	2 54 59
12	14 07 12.71 - 10.87	- 10 08 10.6 + 54.8	6.15	11.56	0.761 329 - 7 193	2 50 55
13	14 07 01.84 - 13.83	10 07 15.8 + 68.4	6.21	11.67	.754 136 7 068	2 46 48
14	14 06 48.01 - 16.82	10 06 07.4 + 81.7	6.26	11.78	.747 068 6 939	2 42 38
15	14 06 31.19 - 19.81	10 04 45.7 + 95.2	6.32	11.89	.740 129 6 807	2 38 25
16	14 06 11.38 - 22.81	10 03 10.5 + 108.7	6.38	12.00	.733 322 6 671	2 34 09
17	14 05 48.57 - 25.80	- 10 01 21.8 + 121.9	6.44	12.11	0.726 651 - 6 532	2 29 50
18	14 05 22.77 - 28.80	9 59 19.9 + 135.2	6.50	12.22	.720 119 6 390	2 25 28
19	14 04 53.97 - 31.79	9 57 04.7 + 148.5	6.56	12.33	.713 729 6 244	2 21 03
20	14 04 22.18 - 34.76	9 54 36.2 + 161.5	6.61	12.44	.707 485 6 095	2 16 35
21	14 03 47.42 - 37.72	9 51 54.7 + 174.4	6.67	12.55	.701 390 5 943	2 12 05
22	14 03 09.70 - 40.66	- 9 49 00.3 + 187.3	6.73	12.65	0.695 447 - 5 789	2 07 31
23	14 02 29.04 - 43.58	9 45 53.0 + 200.1	6.79	12.76	.689 658 5 632	2 02 54
24	14 01 45.46 - 46.46	9 42 32.9 + 212.6	6.84	12.87	.684 026 5 471	1 58 15
25	14 00 59.00 - 49.32	9 39 00.3 + 225.1	6.90	12.97	.678 555 5 308	1 53 33
26	14 00 09.68 - 52.13	9 35 15.2 + 237.4	6.95	13.07	.673 247 5 141	1 48 48
27	13 59 17.55 - 54.89	- 9 31 17.8 + 249.3	7.00	13.17	0.668 106 - 4 973	1 44 00
28	13 58 22.66 - 57.60	9 27 08.5 + 261.2	7.06	13.27	.663 133 4 800	1 39 09
29	13 57 25.06 - 60.27	9 22 47.3 + 272.7	7.11	13.37	.658 333 4 624	1 34 16
30	13 56 24.79 - 62.86	9 18 14.6 + 283.9	7.16	13.46	.653 709 4 446	1 29 20
31	13 55 21.93 - 65.38	9 13 30.7 + 294.9	7.21	13.55	.649 263 4 265	1 24 21
Apr. 1	13 54 16.55 - 67.83	- 9 08 35.8 + 305.3	7.26	13.64	0.644 998 - 4 079	1 19 20
2	13 53 08.72 - 67.83	- 9 03 30.5 + 305.3	7.30	13.73	0.640 919 - 4 079	1 14 17

MARS, 1967
FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] [″]	[″]	[″]		^h ^m ^s
Apr. 1	13 54 16.55 - 67.83	- 9 08 35.8 + 305.3	7.26	13.64	0.644 998 - 4 079	1 19 20
2	13 53 08.72 70.16	9 03 30.5 + 315.4	7.30	13.73	.640 919 3 892	1 14 17
3	13 51 58.56 72.41	8 58 15.1 324.9	7.35	13.81	.637 027 3 701	1 09 11
4	13 50 46.15 74.55	8 52 50.2 333.9	7.39	13.89	.633 326 3 568	1 04 03
5	13 49 31.60 76.56	8 47 16.3 342.5	7.43	13.97	.629 818 3 312	0 58 53
6	13 48 15.04 - 78.44	- 8 41 33.8 + 350.2	7.47	14.05	0.626 506 - 3 114	0 53 41
7	13 46 56.60 80.19	8 35 43.6 357.3	7.51	14.12	.623 392 2 914	0 48 27
8	13 45 36.41 81.79	8 29 46.3 363.7	7.54	14.18	.620 478 2 712	0 43 11
9	13 44 14.62 83.24	8 23 42.6 369.3	7.58	14.24	.617 766 2 508	0 37 54
10	13 42 51.38 84.54	8 17 33.3 374.1	7.61	14.30	.615 258 2 304	0 32 35
11	13 41 26.84 - 85.66	- 8 11 19.2 + 378.1	7.64	14.36	0.612 954 - 2 098	0 27 16
12	13 40 01.18 86.64	8 05 01.1 381.3	7.66	14.41	.610 856 1 891	0 21 54
13	13 38 34.54 87.42	7 58 39.8 383.4	7.69	14.45	.608 965 1 685	0 16 32
14	13 37 07.12 88.05	7 52 16.4 384.9	7.71	14.49	.607 280 1 477	0 11 10
15	13 35 39.07 88.50	7 45 51.5 385.3	7.73	14.53	.605 803 1 270	0 05 46
16	13 34 10.57 - 88.77	- 7 39 26.2 + 384.8	7.74	14.56	0.604 533 - 1 063	{ 0 00 22 } { 23 54 58 }
17	13 32 41.80 88.86	7 33 01.4 383.4	7.76	14.58	.603 470 858	23 49 34
18	13 31 12.94 88.80	7 26 38.0 381.2	7.77	14.60	.602 612 653	23 44 10
19	13 29 44.14 88.55	7 20 16.8 378.1	7.77	14.62	.601 959 450	23 38 46
20	13 28 15.59 88.14	7 13 58.7 374.1	7.78	14.63	.601 509 247	23 33 23
21	13 26 47.45 - 87.57	- 7 07 44.6 + 369.2	7.78	14.64	0.601 262 - 47	23 28 00
22	13 25 19.88 86.83	7 01 35.4 363.6	7.78	14.64	.601 215 + 152	23 22 38
23	13 23 53.05 85.93	6 55 31.8 357.2	7.78	14.63	.601 367 348	23 17 16
24	13 22 27.12 84.89	6 49 34.6 349.8	7.78	14.62	.601 715 543	23 11 56
25	13 21 02.23 83.70	6 43 44.8 341.9	7.77	14.61	.602 258 735	23 06 37
26	13 19 38.53 - 82.37	- 6 38 02.9 + 333.1	7.76	14.59	0.602 993 + 926	23 01 19
27	13 18 16.16 80.89	6 32 29.8 323.7	7.75	14.57	.603 919 1 114	22 56 03
28	13 16 55.27 79.28	6 27 06.1 313.6	7.74	14.54	.605 033 1 300	22 50 48
29	13 15 35.99 77.54	6 21 52.5 302.7	7.72	14.51	.606 333 1 484	22 45 35
30	13 14 18.45 75.68	6 16 49.8 291.2	7.70	14.48	.607 817 1 665	22 40 24
May 1	13 13 02.77 - 73.68	- 6 11 58.6 + 279.0	7.68	14.44	0.609 482 + 1 843	22 35 14
2	13 11 49.09 71.56	6 07 19.6 266.1	7.66	14.39	.611 325 2 018	22 30 07
3	13 10 37.53 69.34	6 02 53.5 252.8	7.63	14.35	.613 343 2 190	22 25 02
4	13 09 28.19 67.01	5 58 40.7 238.8	7.60	14.30	.615 533 2 358	22 20 00
5	13 08 21.18 64.56	5 54 41.9 224.4	7.57	14.24	.617 891 2 524	22 14 59
6	13 07 16.62 - 62.05	- 5 50 57.5 + 209.3	7.54	14.18	0.620 415 + 2 685	22 10 02
7	13 06 14.57 59.42	5 47 28.2 193.8	7.51	14.12	.623 100 2 843	22 05 06
8	13 05 15.15 56.74	5 44 14.4 178.0	7.48	14.06	.625 943 2 997	22 00 14
9	13 04 18.41 53.97	5 41 16.4 161.7	7.44	13.99	.628 940 3 147	21 55 24
10	13 03 24.44 51.14	5 38 34.7 145.1	7.40	13.92	.632 087 3 292	21 50 37
11	13 02 33.30 - 48.26	- 5 36 09.6 + 128.3	7.37	13.85	0.635 379 + 3 435	21 45 53
12	13 01 45.04 45.34	5 34 01.3 111.3	7.33	13.78	.638 814 3 571	21 41 12
13	13 00 59.70 42.37	5 32 10.0 93.9	7.29	13.70	.642 385 3 705	21 36 33
14	13 00 17.33 39.36	5 30 36.1 76.6	7.24	13.62	.646 090 3 833	21 31 58
15	12 59 37.97 36.35	5 29 19.5 59.0	7.20	13.54	.649 923 3 957	21 27 26
16	12 59 01.62 - 33.32	- 5 28 20.5 + 41.6	7.16	13.46	0.653 880 + 4 078	21 22 56
17	12 58 28.30	- 5 27 38.9	7.11	13.37	0.657 958	21 18 30

MARS, 1967
FOR 0^h EPHEMERIS TIME

197

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
May 17	12 58 28.30 - 30.26	- 5 27 38.9 + 24.0	7.11	13.37	0.657 958 + 4 193	21 18 30
18	12 57 58.04 - 27.22	5 27 14.9 + 6.4	7.07	13.29	.662 151 + 4 305	21 14 07
19	12 57 30.82 - 24.17	5 27 08.5 - 10.9	7.02	13.20	.666 456 + 4 412	21 09 46
20	12 57 06.65 - 21.14	5 27 19.4 - 28.2	6.98	13.12	.670 868 + 4 516	21 05 29
21	12 56 45.51 - 18.10	5 27 47.6 - 45.5	6.93	13.03	.675 384 + 4 615	21 01 15
22	12 56 27.41 - 15.09	- 5 28 33.1 - 62.5	6.88	12.94	0.679 999 + 4 711	20 57 04
23	12 56 12.32 - 12.11	5 29 35.6 - 79.4	6.84	12.85	.684 710 + 4 804	20 52 55
24	12 56 00.21 - 9.13	5 30 55.0 - 96.1	6.79	12.76	.689 514 + 4 893	20 48 50
25	12 55 51.08 - 6.18	5 32 31.1 - 112.7	6.74	12.67	.694 407 + 4 980	20 44 47
26	12 55 44.90 - 3.27	5 34 23.8 - 128.9	6.69	12.58	.699 387 + 5 063	20 40 48
27	12 55 41.63 - 0.37	- 5 36 32.7 - 145.2	6.64	12.49	0.704 450 + 5 142	20 36 51
28	12 55 41.26 + 2.49	5 38 57.9 - 161.0	6.60	12.40	.709 592 + 5 221	20 32 57
29	12 55 43.75 + 5.35	5 41 38.9 - 176.9	6.55	12.31	.714 813 + 5 294	20 29 06
30	12 55 49.10 + 8.16	5 44 35.8 - 192.5	6.50	12.22	.720 107 + 5 367	20 25 18
31	12 55 57.26 + 10.96	5 47 48.3 - 207.8	6.45	12.13	.725 474 + 5 434	20 21 33
June 1	12 56 08.22 + 13.72	- 5 51 16.1 - 223.1	6.40	12.04	0.730 908 + 5 501	20 17 50
2	12 56 21.94 + 16.46	5 54 59.2 - 238.1	6.36	11.95	.736 409 + 5 563	20 14 10
3	12 56 38.40 + 19.17	5 58 57.3 - 252.9	6.31	11.86	.741 972 + 5 623	20 10 33
4	12 56 57.57 + 21.84	6 03 10.2 - 267.6	6.26	11.77	.747 595 + 5 680	20 06 58
5	12 57 19.41 + 24.48	6 07 37.8 - 281.9	6.21	11.68	.753 275 + 5 735	20 03 26
6	12 57 43.89 + 27.10	- 6 12 19.7 - 296.1	6.17	11.59	0.759 010 + 5 786	19 59 57
7	12 58 10.99 + 29.66	6 17 15.8 - 310.0	6.12	11.51	.764 796 + 5 835	19 56 30
8	12 58 40.65 + 32.21	6 22 25.8 - 323.7	6.07	11.42	.770 631 + 5 882	19 53 06
9	12 59 12.86 + 34.71	6 27 49.5 - 337.1	6.03	11.33	.776 513 + 5 925	19 49 44
10	12 59 47.57 + 37.17	6 33 26.6 - 350.3	5.98	11.25	.782 438 + 5 965	19 46 25
11	13 00 24.74 + 39.59	- 6 39 16.9 - 363.2	5.94	11.16	0.788 403 + 6 004	19 43 08
12	13 01 04.33 + 41.98	6 45 20.1 - 375.7	5.89	11.08	.794 407 + 6 039	19 39 53
13	13 01 46.31 + 44.31	6 51 35.8 - 388.1	5.85	10.99	.800 446 + 6 072	19 36 41
14	13 02 30.62 + 46.61	6 58 03.9 - 400.1	5.80	10.91	.806 518 + 6 103	19 33 31
15	13 03 17.23 + 48.86	7 04 44.0 - 411.8	5.76	10.83	.812 621 + 6 132	19 30 23
16	13 04 06.09 + 51.08	- 7 11 35.8 - 423.1	5.72	10.75	0.818 753 + 6 158	19 27 18
17	13 04 57.17 + 53.25	7 18 38.9 - 434.2	5.67	10.67	.824 911 + 6 182	19 24 14
18	13 05 50.42 + 55.39	7 25 53.1 - 445.0	5.63	10.59	.831 093 + 6 205	19 21 13
19	13 06 45.81 + 57.47	7 33 18.1 - 455.5	5.59	10.51	.837 298 + 6 225	19 18 14
20	13 07 43.28 + 59.53	7 40 53.6 - 465.6	5.55	10.43	.843 523 + 6 246	19 15 17
21	13 08 42.81 + 61.53	- 7 48 39.2 - 475.4	5.51	10.36	0.849 769 + 6 263	19 12 22
22	13 09 44.34 + 63.51	7 56 34.6 - 485.1	5.47	10.28	.856 032 + 6 281	19 09 29
23	13 10 47.85 + 65.44	8 04 39.7 - 494.3	5.43	10.21	.862 313 + 6 296	19 06 38
24	13 11 53.29 + 67.34	8 12 54.0 - 503.3	5.39	10.13	.868 609 + 6 311	19 03 48
25	13 13 00.63 + 69.22	8 21 17.3 - 512.1	5.35	10.06	.874 920 + 6 325	19 01 01
26	13 14 09.85 + 71.07	- 8 29 49.4 - 520.7	5.31	9.99	0.881 245 + 6 337	18 58 15
27	13 15 20.92 + 72.89	8 38 30.1 - 528.9	5.27	9.91	.887 582 + 6 349	18 55 32
28	13 16 33.81 + 74.67	8 47 19.0 - 537.1	5.24	9.84	.893 931 + 6 359	18 52 50
29	13 17 48.48 + 76.45	8 56 16.1 - 544.9	5.20	9.77	.900 290 + 6 369	18 50 09
30	13 19 04.93 + 78.20	9 05 21.0 - 552.5	5.16	9.71	.906 659 + 6 376	18 47 31
July 1	13 20 23.13 + 79.92	- 9 14 33.5 - 560.0	5.13	9.64	0.913 035 + 6 384	18 44 54
2	13 21 43.05 + 81.74	- 9 23 53.5 - 568.1	5.09	9.57	0.919 419 + 6 391	18 42 19

MARS, 1967

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
July 1	13 20 23.13	- 9 14 33.5	5.13	9.64	0.913 035	18 44 54
2	13 21 43.05	9 23 53.5	5.09	9.57	.919 419	18 42 19
3	13 23 04.67	9 33 20.8	5.06	9.51	.925 808	18 39 46
4	13 24 27.97	9 42 55.0	5.02	9.44	.932 202	18 37 14
5	13 25 52.93	9 52 36.1	4.99	9.38	.938 600	18 34 44
6	13 27 19.52	-10 02 23.7	4.95	9.31	0.945 001	18 32 16
7	13 28 47.72	10 12 17.7	4.92	9.25	.951 402	18 29 49
8	13 30 17.51	10 22 17.9	4.89	9.19	.957 803	18 27 23
9	13 31 48.87	10 32 23.9	4.85	9.13	.964 204	18 25 00
10	13 33 21.77	10 42 35.7	4.82	9.07	.970 602	18 22 37
11	13 34 56.20	-10 52 52.8	4.79	9.01	0.976 997	18 20 17
12	13 36 32.12	11 03 15.1	4.76	8.95	.983 387	18 17 57
13	13 38 09.51	11 13 42.3	4.73	8.89	.989 771	18 15 40
14	13 39 48.37	11 24 14.2	4.70	8.83	0.996 148	18 13 23
15	13 41 28.65	11 34 50.5	4.67	8.78	1.002 518	18 11 08
16	13 43 10.35	-11 45 30.9	4.64	8.72	1.008 880	18 08 55
17	13 44 53.44	11 56 15.3	4.61	8.67	.015 233	18 06 42
18	13 46 37.89	12 07 03.3	4.58	8.61	.021 577	18 04 31
19	13 48 23.70	12 17 54.8	4.55	8.56	.027 911	18 02 22
20	13 50 10.83	12 28 49.4	4.53	8.51	.034 235	18 00 14
21	13 51 59.27	-12 39 46.9	4.50	8.46	1.040 549	17 58 07
22	13 53 49.01	12 50 47.1	4.47	8.41	.046 853	17 56 01
23	13 55 40.03	13 01 49.7	4.44	8.36	.053 147	17 53 57
24	13 57 32.31	13 12 54.7	4.42	8.31	.059 430	17 51 53
25	13 59 25.85	13 24 01.6	4.39	8.26	.065 702	17 49 52
26	14 01 20.63	-13 35 10.4	4.37	8.21	1.071 964	17 47 51
27	14 03 16.66	13 46 20.8	4.34	8.16	.078 214	17 45 51
28	14 05 13.92	13 57 32.7	4.32	8.11	.084 454	17 43 53
29	14 07 12.40	14 08 45.9	4.29	8.07	.090 682	17 41 56
30	14 09 12.09	14 20 00.2	4.27	8.02	.096 898	17 40 00
31	14 11 13.00	-14 31 15.4	4.24	7.98	1.103 101	17 38 06
Aug. 1	14 13 15.12	14 42 31.2	4.22	7.93	.109 293	17 36 12
2	14 15 18.43	14 53 47.6	4.20	7.89	.115 472	17 34 20
3	14 17 22.92	15 05 04.3	4.17	7.85	.121 637	17 32 29
4	14 19 28.61	15 16 21.1	4.15	7.80	.127 788	17 30 39
5	14 21 35.46	-15 27 37.8	4.13	7.76	1.133 926	17 28 50
6	14 23 43.48	15 38 54.3	4.11	7.72	.140 049	17 27 03
7	14 25 52.66	15 50 10.1	4.08	7.68	.146 156	17 25 16
8	14 28 02.99	16 01 25.3	4.06	7.64	.152 248	17 23 31
9	14 30 14.45	16 12 39.4	4.04	7.60	.158 323	17 21 47
10	14 32 27.05	-16 23 52.3	4.02	7.56	1.164 381	17 20 04
11	14 34 40.77	16 35 03.7	4.00	7.52	.170 422	17 18 22
12	14 36 55.61	16 46 13.5	3.98	7.48	.176 445	17 16 41
13	14 39 11.55	16 57 21.3	3.96	7.44	.182 451	17 15 02
14	14 41 28.59	17 08 27.0	3.94	7.40	.188 439	17 13 23
15	14 43 46.70	-17 19 30.3	3.92	7.37	1.194 409	17 11 45
16	14 46 05.89	17 30 31.0	3.90	7.33	1.200 361	17 10 09

MARS, 1967

FOR 0^h EPHEMERIS TIME

199

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Aug. 16	14 46 05.89 +140.24	-17 30 31.0 - 657.8	3.90	7.33	1.200 361 + 5 935	17 10 09
17	14 48 26.13 141.30	17 41 28.8 - 654.7	3.88	7.30	.206 296 + 5 917	17 08 33
18	14 50 47.43 142.34	17 52 23.5 - 651.3	3.86	7.26	.212 213 5 900	17 06 59
19	14 53 09.77 143.38	18 03 14.8 - 647.8	3.84	7.22	.218 113 5 884	17 05 26
20	14 55 33.15 144.41	18 14 02.6 - 644.1	3.82	7.19	.223 997 5 867	17 03 53
21	14 57 57.56 +145.44	-18 24 46.7 - 640.0	3.81	7.16	1.229 864 + 5 851	17 02 22
22	15 00 23.00 146.47	18 35 26.7 - 635.9	3.79	7.12	.235 715 5 835	17 00 52
23	15 02 49.47 147.49	18 46 02.6 - 631.5	3.77	7.09	.241 550 5 820	16 59 22
24	15 05 16.96 148.52	18 56 34.1 - 626.9	3.75	7.05	.247 370 5 804	16 57 54
25	15 07 45.48 149.53	19 07 01.0 - 622.1	3.73	7.02	.253 174 5 788	16 56 27
26	15 10 15.01 +150.55	-19 17 23.1 - 617.2	3.72	6.99	1.258 962 + 5 773	16 55 01
27	15 12 45.56 151.57	19 27 40.3 - 612.0	3.70	6.96	.264 735 5 758	16 53 36
28	15 15 17.13 152.58	19 37 52.3 - 606.6	3.68	6.93	.270 493 5 742	16 52 11
29	15 17 49.71 153.58	19 47 58.9 - 601.1	3.67	6.90	.276 235 5 728	16 50 48
30	15 20 23.29 154.60	19 58 00.0 - 595.2	3.65	6.86	.281 963 5 712	16 49 26
31	15 22 57.89 +155.59	-20 07 55.2 - 589.3	3.63	6.83	1.287 675 + 5 697	16 48 05
Sept. 1	15 25 33.48 156.59	20 17 44.5 - 583.1	3.62	6.80	.293 372 5 681	16 46 45
2	15 28 10.07 157.58	20 27 27.6 - 576.6	3.60	6.77	.299 053 5 666	16 45 25
3	15 30 47.65 158.56	20 37 04.2 - 569.9	3.59	6.74	.304 719 5 650	16 44 07
4	15 33 26.21 159.55	20 46 34.1 - 563.2	3.57	6.72	.310 369 5 633	16 42 50
5	15 36 05.76 +160.52	-20 55 57.3 - 555.9	3.56	6.69	1.316 002 + 5 618	16 41 34
6	15 38 46.28 161.49	21 05 13.2 - 548.7	3.54	6.66	.321 620 5 600	16 40 18
7	15 41 27.77 162.44	21 14 21.9 - 541.0	3.53	6.63	.327 220 5 583	16 39 04
8	15 44 10.21 163.40	21 23 22.9 - 533.3	3.51	6.60	.332 803 5 566	16 37 51
9	15 46 53.61 164.34	21 32 16.2 - 525.2	3.50	6.58	.338 369 5 549	16 36 38
10	15 49 37.95 +165.27	-21 41 01.4 - 517.0	3.48	6.55	1.343 918 + 5 533	16 35 27
11	15 52 23.22 166.18	21 49 38.4 - 508.5	3.47	6.52	.349 451 5 515	16 34 16
12	15 55 09.40 167.08	21 58 06.9 - 499.8	3.45	6.49	.354 966 5 500	16 33 06
13	15 57 56.48 167.97	22 06 26.7 - 490.9	3.44	6.47	.360 466 5 483	16 31 58
14	16 00 44.45 168.86	22 14 37.6 - 481.7	3.43	6.44	.365 949 5 467	16 30 50
15	16 03 33.31 +169.72	-22 22 39.3 - 472.4	3.41	6.42	1.371 416 + 5 453	16 29 43
16	16 06 23.03 170.58	22 30 31.7 - 462.7	3.40	6.39	.376 869 5 437	16 28 36
17	16 09 13.61 171.43	22 38 14.4 - 453.0	3.39	6.37	.382 306 5 424	16 27 31
18	16 12 05.04 172.28	22 45 47.4 - 442.9	3.37	6.34	.387 730 5 409	16 26 27
19	16 14 57.32 173.12	22 53 10.3 - 432.8	3.36	6.32	.393 139 5 396	16 25 23
20	16 17 50.44 +173.94	-23 00 23.1 - 422.3	3.35	6.29	1.398 535 + 5 384	16 24 20
21	16 20 44.38 174.77	23 07 25.4 - 411.8	3.33	6.27	.403 919 5 370	16 23 18
22	16 23 39.15 175.59	23 14 17.2 - 401.0	3.32	6.24	.409 289 5 359	16 22 17
23	16 26 34.74 176.39	23 20 58.2 - 390.1	3.31	6.22	.414 648 5 346	16 21 17
24	16 29 31.13 177.19	23 27 28.3 - 378.9	3.30	6.20	.419 994 5 335	16 20 17
25	16 32 28.32 +177.98	-23 33 47.2 - 367.6	3.28	6.17	1.425 329 + 5 323	16 19 18
26	16 35 26.30 178.77	23 39 54.8 - 356.2	3.27	6.15	.430 652 5 312	16 18 20
27	16 38 25.07 179.53	23 45 51.0 - 344.5	3.26	6.13	.435 964 5 301	16 17 23
28	16 41 24.60 180.29	23 51 35.5 - 332.7	3.25	6.11	.441 265 5 290	16 16 27
29	16 44 24.89 181.04	23 57 08.2 - 320.6	3.24	6.08	.446 555 5 278	16 15 31
30	16 47 25.93 +181.78	-24 02 28.8 - 308.4	3.22	6.06	1.451 833 + 5 269	16 14 36
Oct. 1	16 50 27.71	-24 07 37.2	3.21	6.04	1.457 102	16 13 42

MARS, 1967
FOR 0^h EPHEMERIS TIME

Date		Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephe- meris Transit
		^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Oct.	1	16 50 27.71 ^s +182.50	-24 07 37.2 ["] - 295.9	3.21	6.04	1.457 102	16 13 42
	2	16 53 30.21 ^s 183.22	24 12 33.1 ["] 283.4	3.20	6.02	.462 358 + 5 256	16 12 48
	3	16 56 33.43 ^s 183.92	24 17 16.5 ["] 270.5	3.19	6.00	.467 604 5 246	16 11 55
	4	16 59 37.35 ^s 184.61	24 21 47.0 ["] 257.6	3.18	5.97	.472 838 5 234	16 11 03
	5	17 02 41.96 ^s 185.28	24 26 04.6 ["] 244.5	3.17	5.95	.478 060 5 211	16 10 12
	6	17 05 47.24 ^s +185.94	-24 30 09.1 ["] - 231.2	3.16	5.93	1.483 271 + 5 199	16 09 21
	7	17 08 53.18 ^s 186.58	24 34 00.3 ["] 217.7	3.14	5.91	.488 470 5 186	16 08 31
	8	17 11 59.76 ^s 187.20	24 37 38.0 ["] 204.2	3.13	5.89	.493 656 5 175	16 07 41
	9	17 15 06.96 ^s 187.79	24 41 02.2 ["] 190.3	3.12	5.87	.498 831 5 164	16 06 52
	10	17 18 14.75 ^s 188.37	24 44 12.5 ["] 176.5	3.11	5.85	.503 995 5 153	16 06 04
	11	17 21 23.12 ^s +188.92	-24 47 09.0 ["] - 162.4	3.10	5.83	1.509 148 + 5 142	16 05 16
	12	17 24 32.04 ^s 189.45	24 49 51.4 ["] 148.2	3.09	5.81	.514 290 5 131	16 04 29
	13	17 27 41.49 ^s 189.98	24 52 19.6 ["] 133.9	3.08	5.79	.519 421 5 122	16 03 42
	14	17 30 51.47 ^s 190.47	24 54 33.5 ["] 119.3	3.07	5.77	.524 543 5 112	16 02 56
	15	17 34 01.94 ^s 190.95	24 56 32.8 ["] 104.8	3.06	5.75	.529 655 5 104	16 02 10
	16	17 37 12.89 ^s +191.42	-24 58 17.6 ["] - 90.1	3.05	5.73	1.534 759 + 5 095	16 01 25
	17	17 40 24.31 ^s 191.88	24 59 47.7 ["] 75.2	3.04	5.71	.539 854 5 088	16 00 40
	18	17 43 36.19 ^s 192.30	25 01 02.9 ["] 60.3	3.03	5.70	.544 942 5 080	15 59 56
	19	17 46 48.49 ^s 192.73	25 02 03.2 ["] 45.3	3.02	5.68	.550 022 5 073	15 59 12
	20	17 50 01.22 ^s 193.13	25 02 48.5 ["] 30.2	3.01	5.66	.555 095 5 067	15 58 28
	21	17 53 14.35 ^s +193.51	-25 03 18.7 ["] - 15.0	3.00	5.64	1.560 162 + 5 061	15 57 45
	22	17 56 27.86 ^s 193.89	25 03 33.7 ["] + 0.2	2.99	5.62	.565 223 5 054	15 57 02
	23	17 59 41.75 ^s 194.23	25 03 33.5 ["] 15.6	2.98	5.60	.570 277 5 050	15 56 20
	24	18 02 55.98 ^s 194.57	25 03 17.9 ["] 31.0	2.97	5.59	.575 327 5 044	15 55 38
	25	18 06 10.55 ^s 194.89	25 02 46.9 ["] 46.5	2.96	5.57	.580 371 5 039	15 54 56
	26	18 09 25.44 ^s +195.19	-25 02 00.4 ["] + 62.0	2.95	5.55	1.585 410 + 5 034	15 54 15
	27	18 12 40.63 ^s 195.48	25 00 58.4 ["] 77.6	2.94	5.53	.590 444 5 030	15 53 34
	28	18 15 56.11 ^s 195.73	24 59 40.8 ["] 93.3	2.93	5.52	.595 474 5 025	15 52 53
	29	18 19 11.84 ^s 195.99	24 58 07.5 ["] 109.0	2.92	5.50	.600 499 5 020	15 52 12
	30	18 22 27.83 ^s 196.22	24 56 18.5 ["] 124.9	2.91	5.48	.605 519 5 015	15 51 32
	31	18 25 44.05 ^s +196.43	-24 54 13.6 ["] + 140.6	2.91	5.46	1.610 534 + 5 011	15 50 51
Nov.	1	18 29 00.48 ^s 196.64	24 51 53.0 ["] 156.6	2.90	5.45	.615 545 5 005	15 50 11
	2	18 32 17.12 ^s 196.81	24 49 16.4 ["] 172.5	2.89	5.43	.620 550 4 999	15 49 32
	3	18 35 33.93 ^s 196.98	24 46 23.9 ["] 188.4	2.88	5.41	.625 549 4 994	15 48 52
	4	18 38 50.91 ^s 197.11	24 43 15.5 ["] 204.3	2.87	5.40	.630 543 4 988	15 48 13
	5	18 42 08.02 ^s +197.22	-24 39 51.2 ["] + 220.2	2.86	5.38	1.635 531 + 4 983	15 47 33
	6	18 45 25.24 ^s 197.31	24 36 11.0 ["] 236.1	2.85	5.36	.640 514 4 977	15 46 54
	7	18 48 42.55 ^s 197.37	24 32 14.9 ["] 252.0	2.84	5.35	.645 491 4 972	15 46 15
	8	18 51 59.92 ^s 197.41	24 28 02.9 ["] 268.0	2.84	5.33	.650 463 4 967	15 45 36
	9	18 55 17.33 ^s 197.43	24 23 34.9 ["] 283.7	2.83	5.32	.655 430 4 962	15 44 57
	10	18 58 34.76 ^s +197.44	-24 18 51.2 ["] + 299.7	2.82	5.30	1.660 392 + 4 959	15 44 17
	11	19 01 52.20 ^s 197.41	24 13 51.5 ["] 315.5	2.81	5.28	.665 351 4 954	15 43 38
	12	19 05 09.61 ^s 197.38	24 08 36.0 ["] 331.2	2.80	5.27	.670 305 4 952	15 42 59
	13	19 08 26.99 ^s 197.33	24 03 04.8 ["] 347.0	2.79	5.25	.675 257 4 948	15 42 20
	14	19 11 44.32 ^s 197.26	23 57 17.8 ["] 362.7	2.79	5.24	.680 205 4 946	15 41 41
	15	19 15 01.58 ^s +197.17	-23 51 15.1 ["] + 378.3	2.78	5.22	1.685 151 + 4 944	15 41 01
	16	19 18 18.75 ^s	-23 44 56.8 ["]	2.77	5.21	1.690 095	15 40 22

MARS, 1967

FOR 0^h EPHEMERIS TIME

201

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Nov. 16	19 18 18.75 ^s	-23 44 56.8 ["]	2.77	5.21	1.690 095	15 40 22
17	19 21 35.83 ^s	23 38 22.9 ["]	2.76	5.19	.695 037	15 39 42
18	19 24 52.80 ^s	23 31 33.5 ["]	2.75	5.18	.699 978	15 39 03
19	19 28 09.64 ^s	23 24 28.8 ["]	2.74	5.16	.704 919	15 38 23
20	19 31 26.33 ^s	23 17 08.7 ["]	2.74	5.15	.709 858	15 37 43
21	19 34 42.87 ^s	-23 09 33.3 ["]	2.73	5.13	1.714 798	15 37 03
22	19 37 59.24 ^s	23 01 42.8 ["]	2.72	5.12	.719 737	15 36 23
23	19 41 15.42 ^s	22 53 37.3 ["]	2.71	5.10	.724 677	15 35 42
24	19 44 31.40 ^s	22 45 16.7 ["]	2.71	5.09	.729 617	15 35 01
25	19 47 47.18 ^s	22 36 41.3 ["]	2.70	5.07	.734 558	15 34 21
26	19 51 02.73 ^s	-22 27 51.0 ["]	2.69	5.06	1.739 498	15 33 39
27	19 54 18.06 ^s	22 18 46.1 ["]	2.68	5.04	.744 440	15 32 58
28	19 57 33.14 ^s	22 09 26.5 ["]	2.68	5.03	.749 381	15 32 16
29	20 00 47.98 ^s	21 59 52.4 ["]	2.67	5.02	.754 322	15 31 35
30	20 04 02.55 ^s	21 50 04.0 ["]	2.66	5.00	.759 263	15 30 52
Dec. 1	20 07 16.86 ^s	-21 40 01.2 ["]	2.65	4.99	1.764 204	15 30 10
2	20 10 30.89 ^s	21 29 44.4 ["]	2.65	4.97	.769 143	15 29 27
3	20 13 44.62 ^s	21 19 13.6 ["]	2.64	4.96	.774 081	15 28 44
4	20 16 58.03 ^s	21 08 29.0 ["]	2.63	4.95	.779 019	15 28 01
5	20 20 11.12 ^s	20 57 30.8 ["]	2.62	4.93	.783 954	15 27 17
6	20 23 23.87 ^s	-20 46 19.1 ["]	2.62	4.92	1.788 889	15 26 33
7	20 26 36.27 ^s	20 34 54.0 ["]	2.61	4.91	.793 822	15 25 49
8	20 29 48.30 ^s	20 23 15.8 ["]	2.60	4.89	.798 755	15 25 04
9	20 32 59.97 ^s	20 11 24.6 ["]	2.59	4.88	.803 687	15 24 19
10	20 36 11.25 ^s	19 59 20.5 ["]	2.59	4.87	.808 618	15 23 34
11	20 39 22.14 ^s	-19 47 03.8 ["]	2.58	4.85	1.813 549	15 22 48
12	20 42 32.64 ^s	19 34 34.6 ["]	2.57	4.84	.818 481	15 22 01
13	20 45 42.74 ^s	19 21 53.0 ["]	2.57	4.83	.823 412	15 21 15
14	20 48 52.45 ^s	19 08 59.3 ["]	2.56	4.81	.828 345	15 20 28
15	20 52 01.74 ^s	18 55 53.6 ["]	2.55	4.80	.833 278	15 19 40
16	20 55 10.62 ^s	-18 42 36.2 ["]	2.55	4.79	1.838 213	15 18 52
17	20 58 19.08 ^s	18 29 07.3 ["]	2.54	4.77	.843 150	15 18 04
18	21 01 27.12 ^s	18 15 26.9 ["]	2.53	4.76	.848 088	15 17 15
19	21 04 34.74 ^s	18 01 35.3 ["]	2.53	4.75	.853 028	15 16 26
20	21 07 41.94 ^s	17 47 32.7 ["]	2.52	4.74	.857 970	15 15 36
21	21 10 48.71 ^s	-17 33 19.3 ["]	2.51	4.72	1.862 915	15 14 46
22	21 13 55.05 ^s	17 18 55.2 ["]	2.51	4.71	.867 862	15 13 56
23	21 17 00.96 ^s	17 04 20.7 ["]	2.50	4.70	.872 812	15 13 05
24	21 20 06.44 ^s	16 49 35.8 ["]	2.49	4.69	.877 764	15 12 14
25	21 23 11.50 ^s	16 34 40.9 ["]	2.49	4.67	.882 718	15 11 22
26	21 26 16.14 ^s	-16 19 35.9 ["]	2.48	4.66	1.887 674	15 10 30
27	21 29 20.36 ^s	16 04 21.2 ["]	2.47	4.65	.892 632	15 09 37
28	21 32 24.17 ^s	15 48 57.0 ["]	2.47	4.64	.897 590	15 08 44
29	21 35 27.55 ^s	15 33 23.4 ["]	2.46	4.63	.902 550	15 07 51
30	21 38 30.52 ^s	15 17 40.6 ["]	2.45	4.61	.907 510	15 06 57
31	21 41 33.08 ^s	-15 01 48.8 ["]	2.45	4.60	1.912 469	15 06 03
32	21 44 35.20 ^s	14 45 48.4 ["]	2.44	4.59	1.917 429	15 05 08

JUPITER, 1967
FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension			Apparent Declination			Polar S.D.	Hor. Par.	True Distance from the Earth			Ephem- eris Transit		
	^h	^m	^s	[°]	[']	["]	["]	["]				^h	^m	^s
Jan. 0	8	17	38.972	-28.584	+20	10 47.93	+103.20	21.20	2.03	4.334 827	- 5 824	1	41	27
1	8	17	10.388	29.056	20	12 31.13	104.29	21.23	2.03	.329 003	5 535	1	37	03
2	8	16	41.332	29.507	20	14 15.42	105.30	21.26	2.04	.323 468	5 242	1	32	38
3	8	16	11.825	29.937	20	16 00.72	106.20	21.28	2.04	.318 226	4 948	1	28	13
4	8	15	41.888	30.344	20	17 46.92	107.03	21.31	2.04	.313 278	4 648	1	23	47
5	8	15	11.544	-30.728	+20	19 33.95	+107.77	21.33	2.04	4.308 630	- 4 348	1	19	21
6	8	14	40.816	31.089	20	21 21.72	108.43	21.35	2.04	.304 282	4 044	1	14	54
7	8	14	09.727	31.428	20	23 10.15	109.02	21.37	2.05	.300 238	3 738	1	10	28
8	8	13	38.299	31.743	20	24 59.17	109.52	21.39	2.05	.296 500	3 430	1	06	00
9	8	13	06.556	32.036	20	26 48.69	109.96	21.41	2.05	.293 070	3 119	1	01	33
10	8	12	34.520	-32.305	+20	28 38.65	+110.30	21.42	2.05	4.289 951	- 2 807	0	57	05
11	8	12	02.215	32.551	20	30 28.95	110.54	21.44	2.05	.287 144	2 493	0	52	37
12	8	11	29.664	32.771	20	32 19.49	110.70	21.45	2.05	.284 651	2 179	0	48	09
13	8	10	56.893	32.968	20	34 10.19	110.76	21.46	2.05	.282 472	1 862	0	43	40
14	8	10	23.925	33.135	20	36 00.95	110.71	21.47	2.06	.280 610	1 545	0	39	12
15	8	09	50.790	-33.280	+20	37 51.66	+110.57	21.48	2.06	4.279 065	- 1 227	0	34	43
16	8	09	17.510	33.394	20	39 42.23	110.36	21.49	2.06	.277 838	910	0	30	14
17	8	08	44.116	33.484	20	41 32.59	110.04	21.49	2.06	.276 928	591	0	25	45
18	8	08	10.632	33.547	20	43 22.63	109.63	21.49	2.06	.276 337	- 273	0	21	15
19	8	07	37.085	33.582	20	45 12.26	109.14	21.49	2.06	.276 064	+ 46	0	16	46
20	8	07	03.503	-33.592	+20	47 01.40	+108.58	21.49	2.06	4.276 110	+ 364	0	12	17
21	8	06	29.911	33.575	20	48 49.98	107.94	21.49	2.06	.276 474	681	0	07	48
22	8	05	56.336	33.534	20	50 37.92	107.24	21.49	2.06	.277 155	999	{ 0 03 18 }		
23	8	05	22.802	33.468	20	52 25.16	106.47	21.48	2.06	.278 154	1 314	{ 23 58 49 }		
24	8	04	49.334	33.382	20	54 11.63	105.62	21.48	2.06	.279 468	1 631	23 54 20		
25	8	04	15.952	-33.270	+20	55 57.25	+104.74	21.47	2.06	4.281 099	+ 1 944	23 45 22		
26	8	03	42.682	33.139	20	57 41.99	103.77	21.46	2.05	.283 043	2 259	23 40 53		
27	8	03	09.543	32.984	20	59 25.76	102.73	21.45	2.05	.285 302	2 571	23 36 24		
28	8	02	36.559	32.806	21	01 08.49	101.62	21.43	2.05	.287 873	2 882	23 31 56		
29	8	02	03.753	32.604	21	02 50.11	100.43	21.42	2.05	.290 755	3 193	23 27 27		
30	8	01	31.149	-32.375	+21	04 30.54	+ 99.17	21.40	2.05	4.293 948	+ 3 503	23 22 59		
31	8	00	58.774	32.121	21	06 09.71	97.85	21.39	2.05	.297 451	3 811	23 18 31		
Feb. 1	8	00	26.653	31.841	21	07 47.56	96.48	21.37	2.05	.301 262	4 117	23 14 04		
2	7	59	54.812	31.537	21	09 24.04	95.07	21.35	2.04	.305 379	4 423	23 09 37		
3	7	59	23.275	31.209	21	10 59.11	93.60	21.33	2.04	.309 802	4 727	23 05 10		
4	7	58	52.066	-30.859	+21	12 32.71	+ 92.10	21.30	2.04	4.314 529	+ 5 028	23 00 43		
5	7	58	21.207	30.486	21	14 04.81	90.54	21.28	2.04	.319 557	5 328	22 56 17		
6	7	57	50.721	30.091	21	15 35.35	88.96	21.25	2.03	.324 885	5 625	22 51 51		
7	7	57	20.630	29.675	21	17 04.31	87.32	21.22	2.03	.330 510	5 920	22 47 25		
8	7	56	50.955	29.238	21	18 31.63	85.62	21.19	2.03	.336 430	6 212	22 43 00		
9	7	56	21.717	-28.779	+21	19 57.25	+ 83.89	21.16	2.03	4.342 642	+ 6 500	22 38 36		
10	7	55	52.938	28.297	21	21 21.14	82.09	21.13	2.02	.349 142	6 786	22 34 12		
11	7	55	24.641	27.796	21	22 43.23	80.25	21.10	2.02	.355 928	7 069	22 29 48		
12	7	54	56.845	27.274	21	24 03.48	78.38	21.07	2.02	.362 997	7 348	22 25 25		
13	7	54	29.571	26.732	21	25 21.86	76.45	21.03	2.01	.370 345	7 623	22 21 03		
14	7	54	02.839	-26.169	+21	26 38.31	+ 74.51	20.99	2.01	4.377 968	+ 7 895	22 16 41		
15	7	53	36.670		+21	27 52.82		20.96	2.01	4.385 863		22 12 19		

JUPITER, 1967

FOR 0^h EPHEMERIS TIME

203

Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Feb. 15	7 53 36.670	+21 27 52.82	20.96	2.01	4.385 863	22 12 19
16	7 53 11.081	21 29 05.35	20.92	2.00	.394 025	22 07 59
17	7 52 46.090	21 30 15.87	20.88	2.00	.402 451	22 03 38
18	7 52 21.713	21 31 24.37	20.84	1.99	.411 137	21 59 19
19	7 51 57.966	21 32 30.83	20.79	1.99	.420 079	21 55 00
20	7 51 34.862	+21 33 35.24	20.75	1.99	4.429 272	21 50 42
21	7 51 12.415	21 34 37.59	20.71	1.98	.438 712	21 46 24
22	7 50 50.635	21 35 37.87	20.66	1.98	.448 396	21 42 07
23	7 50 29.531	21 36 36.08	20.62	1.97	.458 317	21 37 51
24	7 50 09.115	21 37 32.19	20.57	1.97	.468 474	21 33 35
25	7 49 49.395	+21 38 26.19	20.52	1.96	4.478 861	21 29 20
26	7 49 30.382	21 39 18.06	20.47	1.96	.489 474	21 25 06
27	7 49 12.088	21 40 07.77	20.42	1.96	.500 310	21 20 53
28	7 48 54.527	21 40 55.31	20.37	1.95	.511 363	21 16 40
Mar. 1	7 48 37.707	21 41 40.68	20.32	1.95	.522 631	21 12 28
2	7 48 21.640	+21 42 23.89	20.27	1.94	4.534 110	21 08 17
3	7 48 06.336	21 43 04.94	20.22	1.94	.545 794	21 04 06
4	7 47 51.802	21 43 43.83	20.17	1.93	.557 680	20 59 57
5	7 47 38.043	21 44 20.58	20.11	1.93	.569 763	20 55 48
6	7 47 25.068	21 44 55.18	20.06	1.92	.582 039	20 51 40
7	7 47 12.882	+21 45 27.64	20.00	1.92	4.594 504	20 47 32
8	7 47 01.490	21 45 57.94	19.95	1.91	.607 151	20 43 26
9	7 46 50.898	21 46 26.08	19.89	1.90	.619 977	20 39 20
10	7 46 41.111	21 46 52.05	19.84	1.90	.632 976	20 35 15
11	7 46 32.136	21 47 15.84	19.78	1.89	.646 144	20 31 11
12	7 46 23.975	+21 47 37.45	19.73	1.89	4.659 475	20 27 07
13	7 46 16.635	21 47 56.87	19.67	1.88	.672 965	20 23 05
14	7 46 10.118	21 48 14.09	19.61	1.88	.686 608	20 19 03
15	7 46 04.427	21 48 29.15	19.55	1.87	.700 398	20 15 02
16	7 45 59.565	21 48 42.03	19.50	1.87	.714 332	20 11 02
17	7 45 55.532	+21 48 52.73	19.44	1.86	4.728 404	20 07 03
18	7 45 52.329	21 49 01.29	19.38	1.86	.742 608	20 03 05
19	7 45 49.955	21 49 07.71	19.32	1.85	.756 940	19 59 07
20	7 45 48.408	21 49 12.00	19.26	1.84	.771 395	19 55 10
21	7 45 47.684	21 49 14.18	19.20	1.84	.785 966	19 51 14
22	7 45 47.780	+21 49 14.25	19.15	1.83	4.800 651	19 47 19
23	7 45 48.692	21 49 12.24	19.09	1.83	.815 443	19 43 25
24	7 45 50.415	21 49 08.12	19.03	1.82	.830 339	19 39 31
25	7 45 52.945	21 49 01.92	18.97	1.82	.845 333	19 35 39
26	7 45 56.280	21 48 53.62	18.91	1.81	.860 422	19 31 47
27	7 46 00.419	+21 48 43.21	18.85	1.80	4.875 600	19 27 56
28	7 46 05.361	21 48 30.71	18.79	1.80	.800 864	19 24 05
29	7 46 11.103	21 48 16.13	18.73	1.79	.906 210	19 20 16
30	7 46 17.644	21 47 59.49	18.67	1.79	.921 634	19 16 27
31	7 46 24.978	21 47 40.81	18.62	1.78	.937 130	19 12 39
Apr. 1	7 46 33.101	+21 47 20.11	18.56	1.78	4.952 696	19 08 52
2	7 46 42.007	+21 46 57.40	18.50	1.77	4.968 326	19 05 05

JUPITER, 1967

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]				^h ^m ^s
Apr. 1	7 46 33.101 + 8.906	+21 47 20.11 - 22.71	18.56	1.78	4.952 696 +15 630	19 08 52
2	7 46 42.007 9.684	21 46 57.40 24.72	18.50	1.77	.968 326 15 690	19 05 05
3	7 46 51.691 10.458	21 46 32.68 26.73	18.44	1.77	.984 016 15 747	19 01 20
4	7 47 02.149 11.225	21 46 05.95 28.74	18.38	1.76	4.999 763 15 797	18 57 35
5	7 47 13.374 11.989	21 45 37.21 30.75	18.32	1.75	5.015 560 15 844	18 53 51
6	7 47 25.363 +12.747	+21 45 06.46 - 32.76	18.27	1.75	5.031 404 +15 887	18 50 07
7	7 47 38.110 13.502	21 44 33.70 34.79	18.21	1.74	.047 291 15 924	18 46 25
8	7 47 51.612 14.251	21 43 58.91 36.79	18.15	1.74	.063 215 15 957	18 42 43
9	7 48 05.863 14.995	21 43 22.12 38.82	18.10	1.73	.079 172 15 985	18 39 02
10	7 48 20.858 15.735	21 42 43.30 40.84	18.04	1.73	.095 157 16 010	18 35 21
11	7 48 36.593 +16.468	+21 42 02.46 - 42.84	17.98	1.72	5.111 167 +16 030	18 31 41
12	7 48 53.061 17.195	21 41 19.62 44.84	17.93	1.72	.127 197 16 045	18 28 02
13	7 49 10.256 17.914	21 40 34.78 46.82	17.87	1.71	.143 242 16 055	18 24 24
14	7 49 28.170 18.627	21 39 47.96 48.80	17.81	1.71	.159 297 16 063	18 20 47
15	7 49 46.797 19.330	21 38 59.16 50.77	17.76	1.70	.175 360 16 064	18 17 10
16	7 50 06.127 +20.024	+21 38 08.39 - 52.71	17.70	1.70	5.191 424 +16 063	18 13 34
17	7 50 26.151 20.708	21 37 15.68 54.65	17.65	1.69	.207 487 16 058	18 09 58
18	7 50 46.859 21.384	21 36 21.03 56.59	17.60	1.68	.223 545 16 047	18 06 23
19	7 51 08.243 22.048	21 35 24.44 58.52	17.54	1.68	.239 592 16 034	18 02 49
20	7 51 30.291 22.705	21 34 25.92 60.45	17.49	1.67	.255 626 16 017	17 59 16
21	7 51 52.996 +23.352	+21 33 25.47 - 62.39	17.43	1.67	5.271 643 +15 996	17 55 43
22	7 52 16.348 23.993	21 32 23.08 64.34	17.38	1.66	.287 639 15 973	17 52 11
23	7 52 40.341 24.628	21 31 18.74 66.28	17.33	1.66	.303 612 15 945	17 48 39
24	7 53 04.969 25.258	21 30 12.46 68.22	17.28	1.65	.319 557 15 915	17 45 08
25	7 53 30.227 25.881	21 29 04.24 70.15	17.23	1.65	.335 472 15 882	17 41 38
26	7 53 56.108 +26.497	+21 27 54.09 - 72.05	17.18	1.64	5.351 354 +15 846	17 38 08
27	7 54 22.605 27.104	21 26 42.04 73.94	17.12	1.64	.367 200 15 806	17 34 39
28	7 54 49.709 27.702	21 25 28.10 75.82	17.07	1.63	.383 006 15 763	17 31 11
29	7 55 17.411 28.291	21 24 12.28 77.68	17.02	1.63	.398 769 15 717	17 27 43
30	7 55 45.702 28.873	21 22 54.60 79.56	16.97	1.63	.414 486 15 668	17 24 15
May 1	7 56 14.575 +29.446	+21 21 35.04 - 81.45	16.93	1.62	5.430 154 +15 616	17 20 49
2	7 56 44.021 30.013	21 20 13.59 83.32	16.88	1.62	.445 770 15 560	17 17 22
3	7 57 14.034 30.572	21 18 50.27 85.22	16.83	1.61	.461 330 15 500	17 13 57
4	7 57 44.606 31.125	21 17 25.05 87.11	16.78	1.61	.476 830 15 438	17 10 32
5	7 58 15.731 31.671	21 15 57.94 89.01	16.73	1.60	.492 268 15 371	17 07 07
6	7 58 47.402 +32.211	+21 14 28.93 - 90.91	16.69	1.60	5.507 639 +15 303	17 03 43
7	7 59 19.613 32.743	21 12 58.02 92.82	16.64	1.59	.522 942 15 229	17 00 19
8	7 59 52.356 33.270	21 11 25.20 94.70	16.60	1.59	.538 171 15 154	16 56 57
9	8 00 25.626 33.788	21 09 50.50 96.60	16.55	1.58	.553 325 15 075	16 53 34
10	8 00 59.414 34.298	21 08 13.90 98.48	16.51	1.58	.568 400 14 992	16 50 12
11	8 01 33.712 +34.801	+21 06 35.42 - 100.36	16.46	1.58	5.583 392 +14 907	16 46 51
12	8 02 08.513 35.293	21 04 55.06 102.21	16.42	1.57	.598 299 14 819	16 43 30
13	8 02 43.806 35.777	21 03 12.85 104.06	16.37	1.57	.613 118 14 727	16 40 09
14	8 03 19.583 36.251	21 01 28.79 105.89	16.33	1.56	.627 845 14 632	16 36 49
15	8 03 55.834 36.714	20 59 42.90 107.73	16.29	1.56	.642 477 14 535	16 33 30
16	8 04 32.548 +37.167	+20 57 55.17 - 109.56	16.25	1.56	5.657 012 +14 436	16 30 11
17	8 05 09.715	+20 56 05.61	16.21	1.55	5.671 448	16 26 52

JUPITER, 1967

FOR 0^h EPHEMERIS TIME

205

Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°] ['] ["]	["]		^h ^m ^s
May 17	8 05 09.715 ^s	+20 56 05.61 ["]	16.21	1.55	5.671 448	16 26 52
18	8 05 47.327 ^{+37.612}	20 54 14.23 ^{-111.38}	16.16	1.55	.685 781 ^{+14 333}	16 23 34
19	8 06 25.375 ^{38.048}	20 52 21.01 ^{113.22}	16.12	1.54	.700 009 ^{14 228}	16 20 16
20	8 07 03.852 ^{38.477}	20 50 25.96 ^{115.05}	16.08	1.54	.714 130 ^{14 121}	16 16 59
21	8 07 42.751 ^{38.899}	20 48 29.07 ^{116.89}	16.05	1.54	.728 143 ^{14 013}	16 13 42
	^{39.317}	^{118.73}			^{13 901}	
22	8 08 22.068 ^{+39.728}	+20 46 30.34 ^{-120.56}	16.01	1.53	5.742 044 ^{+13 787}	16 10 25
23	8 09 01.796 ^{40.134}	20 44 29.78 ^{122.35}	15.97	1.53	.755 831 ^{13 673}	16 07 09
24	8 09 41.930 ^{40.530}	20 42 27.43 ^{124.14}	15.93	1.53	.769 504 ^{13 556}	16 03 54
25	8 10 22.460 ^{40.919}	20 40 23.29 ^{125.92}	15.89	1.52	.783 060 ^{13 437}	16 00 38
26	8 11 03.379 ^{41.299}	20 38 17.37 ^{127.67}	15.86	1.52	.796 497 ^{13 315}	15 57 23
27	8 11 44.678 ^{+41.671}	+20 36 09.70 ^{-129.43}	15.82	1.51	5.809 812 ^{+13 193}	15 54 09
28	8 12 26.349 ^{42.036}	20 34 00.27 ^{131.20}	15.78	1.51	.823 005 ^{13 067}	15 50 54
29	8 13 08.385 ^{42.395}	20 31 49.07 ^{132.95}	15.75	1.51	.836 072 ^{12 940}	15 47 41
30	8 13 50.780 ^{42.747}	20 29 36.12 ^{134.71}	15.71	1.50	.849 012 ^{12 809}	15 44 27
31	8 14 33.527 ^{43.094}	20 27 21.41 ^{136.49}	15.68	1.50	.861 821 ^{12 678}	15 41 14
June 1	8 15 16.621 ^{+43.434}	+20 25 04.92 ^{-138.27}	15.65	1.50	5.874 499 ^{+12 543}	15 38 01
2	8 16 00.055 ^{43.770}	20 22 46.65 ^{140.03}	15.61	1.49	.887 042 ^{12 407}	15 34 49
3	8 16 43.825 ^{44.100}	20 20 26.62 ^{141.81}	15.58	1.49	.899 449 ^{12 267}	15 31 37
4	8 17 27.925 ^{44.424}	20 18 04.81 ^{143.56}	15.55	1.49	.911 716 ^{12 127}	15 28 25
5	8 18 12.349 ^{44.743}	20 15 41.25 ^{145.33}	15.52	1.49	.923 843 ^{11 983}	15 25 13
6	8 18 57.092 ^{+45.054}	+20 13 15.92 ^{-147.07}	15.48	1.48	5.935 826 ^{+11 837}	15 22 02
7	8 19 42.146 ^{45.358}	20 10 48.85 ^{148.80}	15.45	1.48	.947 663 ^{11 691}	15 18 51
8	8 20 27.504 ^{45.656}	20 08 20.05 ^{150.52}	15.42	1.48	.959 354 ^{11 540}	15 15 41
9	8 21 13.160 ^{45.944}	20 05 49.53 ^{152.21}	15.39	1.47	.970 894 ^{11 388}	15 12 30
10	8 21 59.104 ^{46.225}	20 03 17.32 ^{153.89}	15.36	1.47	.982 282 ^{11 235}	15 09 20
11	8 22 45.329 ^{+46.496}	+20 00 43.43 ^{-155.57}	15.33	1.47	5.993 517 ^{+11 079}	15 06 11
12	8 23 31.825 ^{46.759}	19 58 07.86 ^{157.24}	15.31	1.47	6.004 596 ^{10 923}	15 03 01
13	8 24 18.584 ^{47.015}	19 55 30.62 ^{158.88}	15.28	1.46	.015 519 ^{10 763}	14 59 52
14	8 25 05.599 ^{47.262}	19 52 51.74 ^{160.53}	15.25	1.46	.026 282 ^{10 603}	14 56 43
15	8 25 52.861 ^{47.504}	19 50 11.21 ^{162.20}	15.22	1.46	.036 885 ^{10 441}	14 53 34
16	8 26 40.365 ^{+47.742}	+19 47 29.01 ^{-163.84}	15.20	1.46	6.047 326 ^{+10 278}	14 50 26
17	8 27 28.107 ^{47.973}	19 44 45.17 ^{165.49}	15.17	1.45	.057 604 ^{10 114}	14 47 17
18	8 28 16.080 ^{48.202}	19 41 59.68 ^{167.11}	15.15	1.45	.067 718 ^{9 949}	14 44 09
19	8 29 04.282 ^{48.424}	19 39 12.57 ^{168.73}	15.12	1.45	.077 667 ^{9 782}	14 41 02
20	8 29 52.706 ^{48.641}	19 36 23.84 ^{170.31}	15.10	1.45	.087 449 ^{9 615}	14 37 54
21	8 30 41.347 ^{+48.852}	+19 33 33.53 ^{-171.88}	15.07	1.44	6.097 064 ^{+ 9 447}	14 34 47
22	8 31 30.199 ^{49.054}	19 30 41.65 ^{173.43}	15.05	1.44	.106 511 ^{9 278}	14 31 39
23	8 32 19.253 ^{49.250}	19 27 48.22 ^{174.96}	15.03	1.44	.115 789 ^{9 107}	14 28 32
24	8 33 08.503 ^{49.441}	19 24 53.26 ^{176.48}	15.01	1.44	.124 896 ^{8 935}	14 25 26
25	8 33 57.944 ^{49.624}	19 21 56.78 ^{178.00}	14.98	1.43	.133 831 ^{8 762}	14 22 19
26	8 34 47.568 ^{+49.804}	+19 18 58.78 ^{-179.52}	14.96	1.43	6.142 593 ^{+ 8 587}	14 19 13
27	8 35 37.372 ^{49.978}	19 15 59.26 ^{181.04}	14.94	1.43	.151 180 ^{8 412}	14 16 06
28	8 36 27.350 ^{50.149}	19 12 58.22 ^{182.56}	14.92	1.43	.159 592 ^{8 234}	14 13 00
29	8 37 17.499 ^{50.316}	19 09 55.66 ^{184.07}	14.90	1.43	.167 826 ^{8 056}	14 09 54
30	8 38 07.815 ^{50.478}	19 06 51.59 ^{185.58}	14.88	1.42	.175 882 ^{7 876}	14 06 49
July 1	8 38 58.293 ^{+50.637}	+19 03 46.01 ^{-187.07}	14.86	1.42	6.183 758 ^{+ 7 694}	14 03 43
2	8 39 48.930	+19 00 38.94	14.84	1.42	6.191 452	14 00 38

JUPITER, 1967
FOR 0^h EPHEMERIS TIME

Date		Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit	
		^h ^m ^s	[°] ['] ["]				^h ^m ^s	
July	1	8 38 58.293 ^s	+19 03 46.01 ["]	-187.07 ["]	14.86 ["]	1.42	6.183 758	14 03 43
	2	8 39 48.930 ^{+50.637}	19 00 38.94 ^{188.54}	188.54 ["]	14.84 ["]	1.42	.191 452 ^{+7 694}	14 00 38
	3	8 40 39.720 ^{50.790}	18 57 30.40 ^{190.02}	190.02 ["]	14.83 ["]	1.42	.198 964 ^{7 512}	13 57 32
	4	8 41 30.658 ^{50.938}	18 54 20.38 ^{191.45}	191.45 ["]	14.81 ["]	1.42	.206 291 ^{7 327}	13 54 27
	5	8 42 21.740 ^{51.082}	18 51 08.93 ^{192.89}	192.89 ["]	14.79 ["]	1.42	.213 433 ^{7 142}	13 51 22
		51.219					6 955	
	6	8 43 12.959	+18 47 56.04	-194.28	14.78	1.41	6.220 388	13 48 17
	7	8 44 04.308 ^{+51.349}	18 44 41.76 ^{195.66}	195.66 ["]	14.76 ["]	1.41	.227 155 ^{+6 767}	13 45 13
	8	8 44 55.781 ^{51.473}	18 41 26.10 ^{197.00}	197.00 ["]	14.74 ["]	1.41	.233 733 ^{6 578}	13 42 08
	9	8 45 47.371 ^{51.590}	18 38 09.10 ^{198.35}	198.35 ["]	14.73 ["]	1.41	.240 120 ^{6 387}	13 39 03
	10	8 46 39.069 ^{51.698}	18 34 50.75 ^{199.67}	199.67 ["]	14.71 ["]	1.41	.246 316 ^{6 196}	13 35 59
		51.799					6 003	
	11	8 47 30.868	+18 31 31.08	-200.98	14.70	1.41	6.252 319	13 32 55
	12	8 48 22.764 ^{+51.896}	18 28 10.10 ^{202.29}	202.29 ["]	14.69 ["]	1.41	.258 130 ^{+5 811}	13 29 50
	13	8 49 14.750 ^{51.986}	18 24 47.81 ^{203.58}	203.58 ["]	14.67 ["]	1.40	.263 746 ^{5 616}	13 26 46
	14	8 50 06.822 ^{52.072}	18 21 24.23 ^{204.86}	204.86 ["]	14.66 ["]	1.40	.269 169 ^{5 423}	13 23 42
	15	8 50 58.978 ^{52.156}	18 17 59.37 ^{206.11}	206.11 ["]	14.65 ["]	1.40	.274 397 ^{5 228}	13 20 38
		52.235					5 032	
	16	8 51 51.213	+18 14 33.26	-207.36	14.64	1.40	6.279 429	13 17 34
	17	8 52 43.523 ^{+52.310}	18 11 05.90 ^{208.57}	208.57 ["]	14.63 ["]	1.40	.284 267 ^{+4 838}	13 14 31
	18	8 53 35.905 ^{52.382}	18 07 37.33 ^{209.75}	209.75 ["]	14.61 ["]	1.40	.288 908 ^{4 641}	13 11 27
	19	8 54 28.351 ^{52.446}	18 04 07.58 ^{210.89}	210.89 ["]	14.60 ["]	1.40	.293 354 ^{4 446}	13 08 23
	20	8 55 20.857 ^{52.506}	18 00 36.69 ^{212.03}	212.03 ["]	14.59 ["]	1.40	.297 603 ^{4 249}	13 05 20
		52.559					4 053	
	21	8 56 13.416	+17 57 04.66	-213.13	14.59	1.40	6.301 656	13 02 16
	22	8 57 06.023 ^{+52.607}	17 53 31.53 ^{214.24}	214.24 ["]	14.58 ["]	1.40	.305 511 ^{+3 855}	12 59 12
	23	8 57 58.673 ^{52.650}	17 49 57.29 ^{215.32}	215.32 ["]	14.57 ["]	1.39	.309 169 ^{3 658}	12 56 09
	24	8 58 51.361 ^{52.688}	17 46 21.97 ^{216.40}	216.40 ["]	14.56 ["]	1.39	.312 629 ^{3 460}	12 53 05
	25	8 59 44.084 ^{52.723}	17 42 45.57 ^{217.46}	217.46 ["]	14.55 ["]	1.39	.315 890 ^{3 261}	12 50 02
		52.755					3 061	
	26	9 00 36.839	+17 39 08.11	-218.53	14.55	1.39	6.318 951	12 46 59
	27	9 01 29.623 ^{+52.784}	17 35 29.58 ^{219.56}	219.56 ["]	14.54 ["]	1.39	.321 813 ^{+2 862}	12 43 55
	28	9 02 22.432 ^{52.809}	17 31 50.02 ^{220.60}	220.60 ["]	14.53 ["]	1.39	.324 473 ^{2 660}	12 40 52
	29	9 03 15.263 ^{52.831}	17 28 09.42 ^{221.60}	221.60 ["]	14.53 ["]	1.39	.326 932 ^{2 459}	12 37 49
	30	9 04 08.112 ^{52.849}	17 24 27.82 ^{222.59}	222.59 ["]	14.52 ["]	1.39	.329 190 ^{2 258}	12 34 45
		52.863					2 054	
Aug.	31	9 05 00.975	+17 20 45.23	-223.55	14.52	1.39	6.331 244	12 31 42
	1	9 05 53.849 ^{+52.874}	17 17 01.68 ^{224.49}	224.49 ["]	14.51 ["]	1.39	.333 095 ^{+1 851}	12 28 39
	2	9 06 46.729 ^{52.880}	17 13 17.19 ^{225.39}	225.39 ["]	14.51 ["]	1.39	.334 742 ^{1 647}	12 25 35
	3	9 07 39.607 ^{52.878}	17 09 31.80 ^{226.26}	226.26 ["]	14.51 ["]	1.39	.336 185 ^{1 443}	12 22 32
	4	9 08 32.479 ^{52.872}	17 05 45.54 ^{227.10}	227.10 ["]	14.50 ["]	1.39	.337 422 ^{1 237}	12 19 29
		52.859					1 032	
	5	9 09 25.338	+17 01 58.44	-227.91	14.50	1.39	6.338 454	12 16 25
	6	9 10 18.178 ^{+52.840}	16 58 10.53 ^{228.69}	228.69 ["]	14.50 ["]	1.39	.339 280 ⁺⁸²⁶	12 13 22
	7	9 11 10.992 ^{52.814}	16 54 21.84 ^{229.45}	229.45 ["]	14.50 ["]	1.39	.339 899 ⁶¹⁹	12 10 19
	8	9 12 03.772 ^{52.780}	16 50 32.39 ^{230.20}	230.20 ["]	14.50 ["]	1.39	.340 313 ⁴¹⁴	12 07 15
	9	9 12 56.517 ^{52.745}	16 46 42.19 ^{230.94}	230.94 ["]	14.50 ["]	1.39	.340 519 ²⁰⁶	12 04 12
		52.703					+	1
	10	9 13 49.220	+16 42 51.25	-231.64	14.50	1.39	6.340 520	12 01 09
	11	9 14 41.880 ^{+52.660}	16 38 59.61 ^{232.33}	232.33 ["]	14.50 ["]	1.39	.340 314 ⁻²⁰⁶	11 58 05
	12	9 15 34.493 ^{52.613}	16 35 07.28 ^{232.97}	232.97 ["]	14.50 ["]	1.39	.339 903 ⁴¹¹	11 55 01
	13	9 16 27.055 ^{52.562}	16 31 14.31 ^{233.60}	233.60 ["]	14.50 ["]	1.39	.339 286 ⁶¹⁷	11 51 58
	14	9 17 19.563 ^{52.508}	16 27 20.71 ^{234.18}	234.18 ["]	14.50 ["]	1.39	.338 464 ⁸²²	11 48 54
		52.448					1 026	
	15	9 18 12.011	+16 23 26.53	-234.72	14.50	1.39	6.337 438	11 45 50
	16	9 19 04.394 ^{+52.383}	+16 19 31.81		14.51	1.39	6.336 208 ^{-1 230}	11 42 46

JUPITER, 1967

FOR 0^h EPHEMERIS TIME

207

Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°] ['] ["]	["]		^h ^m ^s
Aug. 16	9 19 04.394	+16 19 31.81	14.51	1.39	6.336 208	11 42 46
17	9 19 56.706	16 15 36.58	14.51	1.39	334 773	11 39 43
18	9 20 48.943	16 11 40.87	14.51	1.39	333 135	11 36 39
19	9 21 41.099	16 07 44.71	14.52	1.39	331 294	11 33 35
20	9 22 33.170	16 03 48.10	14.52	1.39	329 250	11 30 30
21	9 23 25.152	+15 59 51.08	14.53	1.39	6.327 004	11 27 26
22	9 24 17.043	15 55 53.65	14.53	1.39	324 554	11 24 22
23	9 25 08.839	15 51 55.83	14.54	1.39	321 902	11 21 17
24	9 26 00.537	15 47 57.65	14.54	1.39	319 047	11 18 13
25	9 26 52.136	15 43 59.14	14.55	1.39	315 990	11 15 08
26	9 27 43.630	+15 40 00.31	14.56	1.39	6.312 731	11 12 04
27	9 28 35.016	15 36 01.20	14.57	1.39	309 269	11 08 59
28	9 29 26.291	15 32 01.84	14.58	1.40	305 605	11 05 54
29	9 30 17.449	15 28 02.25	14.58	1.40	301 739	11 02 49
30	9 31 08.486	15 24 02.49	14.59	1.40	297 671	10 59 44
31	9 31 59.396	+15 20 02.59	14.60	1.40	6.293 401	10 56 38
Sept. 1	9 32 50.172	15 16 02.58	14.61	1.40	288 930	10 53 33
2	9 33 40.809	15 12 02.52	14.63	1.40	284 258	10 50 27
3	9 34 31.299	15 08 02.44	14.64	1.40	279 384	10 47 22
4	9 35 21.637	15 04 02.37	14.65	1.40	274 311	10 44 16
5	9 36 11.815	+15 00 02.34	14.66	1.40	6.269 038	10 41 10
6	9 37 01.832	14 56 02.38	14.67	1.40	263 566	10 38 03
7	9 37 51.682	14 52 02.50	14.69	1.41	257 896	10 34 57
8	9 38 41.363	14 48 02.76	14.70	1.41	252 030	10 31 51
9	9 39 30.872	14 44 03.17	14.72	1.41	245 967	10 28 44
10	9 40 20.202	+14 40 03.79	14.73	1.41	6.239 711	10 25 37
11	9 41 09.351	14 36 04.67	14.75	1.41	233 261	10 22 30
12	9 41 58.311	14 32 05.85	14.76	1.41	226 619	10 19 23
13	9 42 47.076	14 28 07.38	14.78	1.41	219 786	10 16 15
14	9 43 35.641	14 24 09.28	14.79	1.42	212 764	10 13 07
15	9 44 24.002	+14 20 11.61	14.81	1.42	6.205 553	10 10 00
16	9 45 12.152	14 16 14.39	14.83	1.42	198 155	10 06 51
17	9 46 00.088	14 12 17.65	14.85	1.42	190 571	10 03 43
18	9 46 47.807	14 08 21.40	14.87	1.42	182 801	10 00 35
19	9 47 35.303	14 04 25.69	14.88	1.43	174 847	9 57 26
20	9 48 22.575	+14 00 30.54	14.90	1.43	6.166 710	9 54 17
21	9 49 09.620	13 56 35.98	14.92	1.43	158 390	9 51 08
22	9 49 56.432	13 52 42.05	14.94	1.43	149 889	9 47 58
23	9 50 43.008	13 48 48.77	14.97	1.43	141 207	9 44 49
24	9 51 29.343	13 44 56.20	14.99	1.44	132 346	9 41 39
25	9 52 15.433	+13 41 04.37	15.01	1.44	6.123 307	9 38 29
26	9 53 01.272	13 37 13.33	15.03	1.44	114 090	9 35 18
27	9 53 46.854	13 33 23.13	15.06	1.44	104 696	9 32 08
28	9 54 32.171	13 29 33.81	15.08	1.44	095 128	9 28 57
29	9 55 17.219	13 25 45.43	15.10	1.45	085 386	9 25 46
30	9 56 01.988	+13 21 58.03	15.13	1.45	6.075 471	9 22 34
Oct. 1	9 56 46.472	+13 18 11.66	15.15	1.45	6.065 385	9 19 22

JUPITER, 1967
FOR 0^h EPHEMERIS TIME

Date		Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
		^h ^m ^s	[°] ['] ["]	[°] ['] ["]	["]	["]	^h ^m ^s
Oct.	1	9 56 46.472 +44.194	+13 18 11.66 -225.30	15.15	1.45	6.065 385 -10 257	9 19 22
	2	9 57 30.666 43.895	13 14 26.36 224.18	15.18	1.45	.055 128 10 424	9 16 10
	3	9 58 14.561 43.594	13 10 42.18 223.05	15.21	1.46	.044 704 10 591	9 12 58
	4	9 58 58.155 43.288	13 06 59.13 221.85	15.23	1.46	.034 113 10 755	9 09 45
	5	9 59 41.443 42.977	13 03 17.28 220.64	15.26	1.46	.023 358 10 917	9 06 32
	6	10 00 24.420 +42.662	+12 59 36.64 -219.36	15.29	1.46	6.012 441 -11 078	9 03 19
	7	10 01 07.082 42.341	12 55 57.28 218.02	15.31	1.47	6.001 363 11 235	9 00 05
	8	10 01 49.423 42.013	12 52 19.26 216.63	15.34	1.47	5.990 128 11 392	8 56 52
	9	10 02 31.436 41.678	12 48 42.63 215.18	15.37	1.47	.978 736 11 544	8 53 37
	10	10 03 13.114 41.335	12 45 07.45 213.68	15.40	1.47	.967 192 11 695	8 50 23
	11	10 03 54.449 +40.988	+12 41 33.77 -212.15	15.43	1.48	5.955 497 -11 844	8 47 08
	12	10 04 35.437 40.633	12 38 01.62 210.56	15.46	1.48	.943 653 11 991	8 43 53
	13	10 05 16.070 40.275	12 34 31.06 208.93	15.49	1.48	.931 662 12 135	8 40 37
	14	10 05 56.345 39.911	12 31 02.13 207.28	15.53	1.49	.919 527 12 277	8 37 21
	15	10 06 36.256 39.543	12 27 34.85 205.61	15.56	1.49	.907 250 12 418	8 34 05
	16	10 07 15.799 +39.170	+12 24 09.24 -203.86	15.59	1.49	5.894 832 -12 556	8 30 48
	17	10 07 54.969 38.793	12 20 45.38 202.11	15.62	1.50	.882 276 12 693	8 27 31
	18	10 08 33.762 38.412	12 17 23.27 200.30	15.66	1.50	.869 583 12 826	8 24 13
	19	10 09 12.174 38.025	12 14 02.97 198.45	15.69	1.50	.856 757 12 959	8 20 56
	20	10 09 50.199 37.633	12 10 44.52 196.56	15.73	1.51	.843 798 13 088	8 17 38
	21	10 10 27.832 +37.236	+12 07 27.96 -194.62	15.76	1.51	5.830 710 -13 216	8 14 19
	22	10 11 05.068 36.831	12 04 13.34 192.62	15.80	1.51	.817 494 13 342	8 11 00
	23	10 11 41.899 36.421	12 01 00.72 190.57	15.84	1.52	.804 152 13 465	8 07 40
	24	10 12 18.320 36.002	11 57 50.15 188.47	15.87	1.52	.790 687 13 585	8 04 21
	25	10 12 54.322 35.575	11 54 41.68 186.31	15.91	1.52	.777 102 13 705	8 01 00
	26	10 13 29.897 +35.142	+11 51 35.37 -184.09	15.95	1.53	5.763 397 -13 821	7 57 40
	27	10 14 05.039 34.700	11 48 31.28 181.83	15.99	1.53	.749 576 13 935	7 54 19
	28	10 14 39.739 34.250	11 45 29.45 179.50	16.02	1.53	.735 641 14 046	7 50 57
	29	10 15 13.989 33.794	11 42 29.95 177.14	16.06	1.54	.721 595 14 155	7 47 35
	30	10 15 47.783 33.331	11 39 32.81 174.71	16.10	1.54	.707 440 14 260	7 44 13
Nov.	31	10 16 21.114 +32.862	+11 36 38.10 -172.26	16.14	1.55	5.693 180 -14 362	7 40 50
	1	10 16 53.976 32.389	11 33 45.84 169.76	16.18	1.55	.678 818 14 462	7 37 27
	2	10 17 26.365 31.910	11 30 56.08 167.20	16.23	1.55	.664 356 14 558	7 34 03
	3	10 17 58.275 31.424	11 28 08.88 164.60	16.27	1.56	.649 798 14 650	7 30 38
	4	10 18 29.699 30.932	11 25 24.28 161.92	16.31	1.56	.635 148 14 739	7 27 14
	5	10 19 00.631 +30.430	+11 22 42.36 -159.18	16.35	1.57	5.620 409 -14 824	7 23 48
	6	10 19 31.061 29.921	11 20 03.18 156.38	16.40	1.57	.605 585 14 906	7 20 22
	7	10 20 00.982 29.404	11 17 26.80 153.54	16.44	1.57	.590 679 14 984	7 16 56
	8	10 20 30.386 28.881	11 14 53.26 150.64	16.48	1.58	.575 695 15 059	7 13 29
	9	10 20 59.267 28.352	11 12 22.62 147.70	16.53	1.58	.560 636 15 130	7 10 02
	10	10 21 27.619 +27.817	+11 09 54.92 -144.74	16.57	1.59	5.545 506 -15 198	7 06 34
	11	10 21 55.436 27.278	11 07 30.18 141.73	16.62	1.59	.530 308 15 262	7 03 06
	12	10 22 22.714 26.734	11 05 08.45 138.69	16.67	1.60	.515 046 15 323	6 59 37
	13	10 22 49.448 26.184	11 02 49.76 135.60	16.71	1.60	.499 723 15 381	6 56 07
	14	10 23 15.632 25.630	11 00 34.16 132.49	16.76	1.60	.484 342 15 434	6 52 37
	15	10 23 41.262 +25.071	+10 58 21.67 -129.32	16.81	1.61	5.468 908 -15 486	6 49 07
	16	10 24 06.333	+10 56 12.35	16.85	1.61	5.453 422	6 45 36

JUPITER, 1967

FOR 0^h EPHEMERIS TIME

209

Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°] ['] ["]	["] ["]		^h ^m ^s
Nov. 16	10 24 06.333 +24.505	+10 56 12.35 -126.12	16.85	1.61	5.453 422 -15 534	6 45 36
17	10 24 30.838 23.935	10 54 06.23 122.87	16.90	1.62	.437 888 15 577	6 42 04
18	10 24 54.773 23.358	10 52 03.36 119.57	16.95	1.62	.422 311 15 618	6 38 32
19	10 25 18.131 22.772	10 50 03.79 116.21	17.00	1.63	.406 693 15 655	6 34 59
20	10 25 40.903 22.181	10 48 07.58 112.82	17.05	1.63	.391 038 15 688	6 31 25
21	10 26 03.084 +21.581	+10 46 14.76 -109.35	17.10	1.64	5.375 350 -15 718	6 27 51
22	10 26 24.665 20.974	10 44 25.41 105.85	17.15	1.64	.359 632 15 744	6 24 17
23	10 26 45.639 20.360	10 42 39.56 102.30	17.20	1.65	.343 888 15 767	6 20 42
24	10 27 05.999 19.736	10 40 57.26 98.69	17.25	1.65	.328 121 15 785	6 17 06
25	10 27 25.735 19.107	10 39 18.57 95.03	17.30	1.66	.312 336 15 799	6 13 29
26	10 27 44.842 +18.472	+10 37 43.54 -91.36	17.35	1.66	5.296 537 -15 810	6 09 52
27	10 28 03.314 17.831	10 36 12.18 87.63	17.40	1.67	.280 727 15 816	6 06 15
28	10 28 21.145 17.184	10 34 44.55 83.87	17.46	1.67	.264 911 15 817	6 02 36
29	10 28 38.329 16.534	10 33 20.68 80.08	17.51	1.68	.249 094 15 814	5 58 57
30	10 28 54.863 15.879	10 32 00.60 76.23	17.56	1.68	.233 280 15 806	5 55 18
Dec. 1	10 29 10.742 +15.217	+10 30 44.37 -72.35	17.62	1.69	5.217 474 -15 794	5 51 37
2	10 29 25.959 14.549	10 29 32.02 68.41	17.67	1.69	.201 680 15 777	5 47 56
3	10 29 40.508 13.872	10 28 23.61 64.42	17.72	1.70	.185 903 15 754	5 44 15
4	10 29 54.380 13.190	10 27 19.19 60.39	17.78	1.70	.170 149 15 726	5 40 32
5	10 30 07.570 12.502	10 26 18.80 56.32	17.83	1.71	.154 423 15 695	5 36 50
6	10 30 20.072 +11.810	+10 25 22.48 -52.25	17.89	1.71	5.138 728 -15 658	5 33 06
7	10 30 31.882 11.114	10 24 30.23 48.14	17.94	1.72	.123 070 15 617	5 29 22
8	10 30 42.996 10.416	10 23 42.09 44.03	18.00	1.72	.107 453 15 570	5 25 37
9	10 30 53.412 9.715	10 22 58.06 39.90	18.05	1.73	.091 883 15 520	5 21 51
10	10 31 03.127 9.010	10 22 18.16 35.75	18.11	1.73	.076 363 15 465	5 18 04
11	10 31 12.137 +8.305	+10 21 42.41 -31.59	18.16	1.74	5.060 898 -15 405	5 14 17
12	10 31 20.442 7.597	10 21 10.82 27.43	18.22	1.74	.045 493 15 340	5 10 30
13	10 31 28.039 6.885	10 20 43.39 23.23	18.27	1.75	.030 153 15 272	5 06 41
14	10 31 34.924 6.172	10 20 20.16 19.02	18.33	1.75	5.014 881 15 198	5 02 52
15	10 31 41.096 5.455	10 20 01.14 14.80	18.38	1.76	4.999 683 15 120	4 59 02
16	10 31 46.551 +4.735	+10 19 46.34 -10.56	18.44	1.77	4.984 563 -15 038	4 55 11
17	10 31 51.286 4.011	10 19 35.78 6.29	18.49	1.77	.969 525 14 951	4 51 20
18	10 31 55.297 3.284	10 19 29.49 2.01	18.55	1.78	.954 574 14 859	4 47 28
19	10 31 58.581 2.553	10 19 27.48 +2.30	18.61	1.78	.939 715 14 762	4 43 35
20	10 32 01.134 1.819	10 19 29.78 6.61	18.66	1.79	.924 953 14 662	4 39 42
21	10 32 02.953 +1.081	+10 19 36.39 +10.94	18.72	1.79	4.910 291 -14 556	4 35 47
22	10 32 04.034 +0.341	10 19 47.33 15.27	18.77	1.80	.895 735 14 445	4 31 52
23	10 32 04.375 -0.400	10 20 02.60 19.59	18.83	1.80	.881 290 14 329	4 27 57
24	10 32 03.975 1.141	10 20 22.19 23.93	18.88	1.81	.866 961 14 209	4 24 00
25	10 32 02.834 1.882	10 20 46.12 28.23	18.94	1.81	.852 752 14 083	4 20 03
26	10 32 00.952 -2.623	+10 21 14.35 +32.55	18.99	1.82	4.838 669 -13 952	4 16 05
27	10 31 58.329 3.362	10 21 46.90 36.84	19.05	1.82	.824 717 13 816	4 12 06
28	10 31 54.967 4.099	10 22 23.74 41.14	19.10	1.83	.810 901 13 673	4 08 07
29	10 31 50.868 4.839	10 23 04.88 45.44	19.16	1.83	.797 228 13 527	4 04 07
30	10 31 46.029 5.576	10 23 50.32 49.72	19.21	1.84	.783 701 13 373	4 00 06
31	10 31 40.453 -6.315	+10 24 40.04 +54.01	19.27	1.84	4.770 328 -13 216	3 56 05
32	10 31 34.138	+10 25 34.05	19.32	1.85	4.757 112	3 52 02

SATURN, 1967

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°]	["]		^h ^m ^s
Jan. 0	23 41 19.928 +12.881	- 4 27 02.21 + 95.68	7.66	0.90	9.736 512 +15 985	17 02 48
1	23 41 32.809 13.218	4 25 26.53 97.75	7.65	.90	.752 497 15 910	16 59 05
2	23 41 46.027 13.553	4 23 48.78 99.83	7.63	.90	.768 407 15 833	16 55 23
3	23 41 59.580 13.886	4 22 08.95 101.88	7.62	.90	.784 240 15 749	16 51 40
4	23 42 13.466 14.219	4 20 27.07 103.93	7.61	.90	.799 989 15 662	16 47 58
5	23 42 27.685 +14.548	- 4 18 43.14 +105.97	7.60	0.90	9.815 651 +15 571	16 44 17
6	23 42 42.233 14.878	4 16 57.17 107.99	7.59	.90	.831 222 15 474	16 40 36
7	23 42 57.111 15.201	4 15 09.18 109.98	7.57	.89	.846 696 15 374	16 36 55
8	23 43 12.312 15.521	4 13 19.20 111.93	7.56	.89	.862 070 15 269	16 33 14
9	23 43 27.833 15.837	4 11 27.27 113.87	7.55	.89	.877 339 15 159	16 29 34
10	23 43 43.670 +16.146	- 4 09 33.40 +115.74	7.54	0.89	9.892 498 +15 046	16 25 54
11	23 43 59.816 16.450	4 07 37.66 117.60	7.53	.89	.907 544 14 928	16 22 14
12	23 44 16.266 16.751	4 05 40.06 119.44	7.52	.89	.922 472 14 806	16 18 35
13	23 44 33.017 17.045	4 03 40.62 121.22	7.50	.89	.937 278 14 679	16 14 56
14	23 44 50.062 17.338	4 01 39.40 122.99	7.49	.88	.951 957 14 550	16 11 17
15	23 45 07.400 +17.626	- 3 59 36.41 +124.73	7.48	0.88	9.966 507 +14 415	16 07 39
16	23 45 25.026 17.912	3 57 31.68 126.46	7.47	.88	.980 922 14 278	16 04 01
17	23 45 42.938 18.193	3 55 25.22 128.16	7.46	.88	9.995 200 14 137	16 00 23
18	23 46 01.131 18.471	3 53 17.06 129.82	7.45	.88	10.009 337 13 992	15 56 45
19	23 46 19.602 18.745	3 51 07.24 131.48	7.44	.88	.023 329 13 845	15 53 08
20	23 46 38.347 +19.016	- 3 48 55.76 +133.10	7.43	0.88	10.037 174 +13 693	15 49 31
21	23 46 57.363 19.284	3 46 42.66 134.68	7.42	.88	.050 867 13 538	15 45 54
22	23 47 16.647 19.545	3 44 27.98 136.25	7.41	.87	.064 405 13 382	15 42 17
23	23 47 36.192 19.803	3 42 11.73 137.78	7.40	.87	.077 787 13 220	15 38 41
24	23 47 55.995 20.056	3 39 53.95 139.26	7.39	.87	.091 007 13 058	15 35 05
25	23 48 16.051 +20.301	- 3 37 34.69 +140.72	7.38	0.87	10.104 065 +12 891	15 31 29
26	23 48 36.352 20.542	3 35 13.97 142.13	7.37	.87	.116 956 12 723	15 27 53
27	23 48 56.894 20.779	3 32 51.84 143.51	7.36	.87	.129 679 12 552	15 24 18
28	23 49 17.673 21.010	3 30 28.33 144.88	7.35	.87	.142 231 12 377	15 20 43
29	23 49 38.683 21.241	3 28 03.45 146.21	7.34	.87	.154 608 12 200	15 17 08
30	23 49 59.924 +21.468	- 3 25 37.24 +147.54	7.33	0.87	10.166 808 +12 021	15 13 34
31	23 50 21.392 21.694	3 23 09.70 148.87	7.33	.86	.178 829 11 837	15 09 59
Feb. 1	23 50 43.086 21.919	3 20 40.83 150.16	7.32	.86	.190 666 11 652	15 06 25
2	23 51 05.005 22.138	3 18 10.67 151.44	7.31	.86	.202 318 11 463	15 02 51
3	23 51 27.143 22.354	3 15 39.23 152.68	7.30	.86	.213 781 11 271	14 59 17
4	23 51 49.497 +22.564	- 3 13 06.55 +153.90	7.29	0.86	10.225 052 +11 076	14 55 44
5	23 52 12.061 22.770	3 10 32.65 155.08	7.28	.86	.236 128 10 879	14 52 10
6	23 52 34.831 22.971	3 07 57.57 156.21	7.28	.86	.247 007 10 679	14 48 37
7	23 52 57.802 23.164	3 05 21.36 157.32	7.27	.86	.257 686 10 475	14 45 04
8	23 53 20.966 23.354	3 02 44.04 158.39	7.26	.86	.268 161 10 269	14 41 32
9	23 53 44.320 +23.537	- 3 00 05.65 +159.42	7.25	0.86	10.278 430 +10 061	14 37 59
10	23 54 07.857 23.717	2 57 26.23 160.42	7.25	.86	.288 491 9 850	14 34 27
11	23 54 31.574 23.893	2 54 45.81 161.40	7.24	.85	.298 341 9 637	14 30 54
12	23 54 55.467 24.064	2 52 04.41 162.35	7.23	.85	.307 978 9 422	14 27 22
13	23 55 19.531 24.234	2 49 22.06 163.27	7.23	.85	.317 400 9 204	14 23 50
14	23 55 43.765 +24.397	- 2 46 38.79 +164.18	7.22	0.85	10.326 604 + 8 985	14 20 19
15	23 56 08.162	- 2 43 54.61	7.21	0.85	10.335 589	14 16 47

SATURN, 1967

FOR 0^h EPHEMERIS TIME

211

Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°]	["]		^h ^m ^s
Feb. 15	23 56 08.162 ^s	− 2 43 54.61 ["]	7.21	0.85	10.335 589	14 16 47
16	23 56 32.719 +24.557	2 41 09.57 +165.04	7.21	.85	.344 353 + 8 764	14 13 16
17	23 56 57.433 24.714	2 38 23.68 165.89	7.20	.85	.352 893 8 540	14 09 45
18	23 57 22.300 24.867	2 35 36.97 166.71	7.20	.85	.361 210 8 317	14 06 14
19	23 57 47.315 25.015	2 32 49.48 167.49	7.19	.85	.369 300 8 090	14 02 43
	25.157	168.23			7 863	
20	23 58 12.472	− 2 30 01.25	7.19	0.85	10.377 163	13 59 12
21	23 58 37.767 +25.295	2 27 12.30 +168.95	7.18	.85	.384 797 + 7 634	13 55 41
22	23 59 03.193 25.426	2 24 22.67 169.63	7.18	.85	.392 202 7 405	13 52 11
23	23 59 28.745 25.552	2 21 32.41 170.26	7.17	.85	.399 375 7 173	13 48 40
24	23 59 54.419 25.674	2 18 41.55 170.86	7.17	.85	.406 316 6 941	13 45 10
	25.790	171.44			6 708	
25	0 00 20.209	− 2 15 50.11	7.16	0.85	10.413 024	13 41 40
26	0 00 46.111 +25.902	2 12 58.13 +171.98	7.16	.84	.419 497 + 6 473	13 38 10
27	0 01 12.125 26.014	2 10 05.61 172.52	7.15	.84	.425 735 6 238	13 34 40
28	0 01 38.248 26.123	2 07 12.56 173.05	7.15	.84	.431 736 6 001	13 31 10
Mar. 1	0 02 04.479 26.231	2 04 19.00 173.56	7.14	.84	.437 499 5 763	13 27 40
	26.336	174.05			5 523	
2	0 02 30.815 +26.435	− 2 01 24.95 +174.51	7.14	0.84	10.443 022 + 5 283	13 24 10
3	0 02 57.250 26.532	1 58 30.44 174.95	7.14	.84	.448 305 5 040	13 20 41
4	0 03 23.782 26.621	1 55 35.49 175.33	7.13	.84	.453 345 4 796	13 17 11
5	0 03 50.403 26.705	1 52 40.16 175.70	7.13	.84	.458 141 4 552	13 13 42
6	0 04 17.108 26.785	1 49 44.46 176.01	7.13	.84	.462 693 4 305	13 10 13
7	0 04 43.893 +26.859	− 1 46 48.45 +176.30	7.12	0.84	10.466 998 + 4 059	13 06 43
8	0 05 10.752 26.927	1 43 52.15 176.56	7.12	.84	.471 057 3 810	13 03 14
9	0 05 37.679 26.992	1 40 55.59 176.78	7.12	.84	.474 867 3 561	12 59 45
10	0 06 04.671 27.053	1 37 58.81 176.98	7.12	.84	.478 428 3 311	12 56 16
11	0 06 31.724 27.110	1 35 01.83 177.15	7.11	.84	.481 739 3 061	12 52 47
12	0 06 58.834 +27.164	− 1 32 04.68 +177.30	7.11	0.84	10.484 800 + 2 811	12 49 18
13	0 07 25.998 27.213	1 29 07.38 177.41	7.11	.84	.487 611 2 558	12 45 50
14	0 07 53.211 27.260	1 26 09.97 177.51	7.11	.84	.490 169 2 308	12 42 21
15	0 08 20.471 27.301	1 23 12.46 177.58	7.11	.84	.492 477 2 055	12 38 52
16	0 08 47.772 27.341	1 20 14.88 177.62	7.11	.84	.494 532 1 803	12 35 23
17	0 09 15.113 +27.375	− 1 17 17.26 +177.63	7.10	0.84	10.496 335 + 1 552	12 31 55
18	0 09 42.488 27.404	1 14 19.63 177.62	7.10	.84	.497 887 1 300	12 28 26
19	0 10 09.892 27.428	1 11 22.01 177.55	7.10	.84	.499 187 1 048	12 24 57
20	0 10 37.320 27.447	1 08 24.46 177.47	7.10	.84	.500 235 796	12 21 29
21	0 11 04.767 27.462	1 05 26.99 177.35	7.10	.84	.501 031 546	12 18 00
22	0 11 32.229 +27.469	− 1 02 29.64 +177.19	7.10	0.84	10.501 577 + 295	12 14 31
23	0 11 59.698 27.474	0 59 32.45 176.99	7.10	.84	.501 872 + 46	12 11 03
24	0 12 27.172 27.473	0 56 35.46 176.77	7.10	.84	.501 918 − 205	12 07 34
25	0 12 54.645 27.471	0 53 38.69 176.55	7.10	.84	.501 713 453	12 04 06
26	0 13 22.116 27.468	0 50 42.14 176.30	7.10	.84	.501 260 703	12 00 37
27	0 13 49.584 +27.462	− 0 47 45.84 +176.05	7.10	0.84	10.500 557 − 951	11 57 08
28	0 14 17.046 27.455	0 44 49.79 175.78	7.10	.84	.499 606 1 200	11 53 40
29	0 14 44.501 27.444	0 41 54.01 175.49	7.10	.84	.498 406 1 448	11 50 11
30	0 15 11.945 27.429	0 38 58.52 175.18	7.10	.84	.496 958 1 696	11 46 43
31	0 15 39.374 27.410	0 36 03.34 174.83	7.11	.84	.495 262 1 944	11 43 14
Apr. 1	0 16 06.784 +27.383	− 0 33 08.51 +174.44	7.11	0.84	10.493 318 − 2 193	11 39 45
2	0 16 34.167	− 0 30 14.07	7.11	0.84	10.491 125	11 36 17

SATURN, 1967

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°]	["]		^h ^m ^s
Apr. 1	0 16 06.784 +27.383	- 0 33 08.51 +174.44	7.11	0.84	10.493 318 - 2 193	11 39 45
2	0 16 34.167 27.351	0 30 14.07 174.01	7.11	.84	.491 125 2 440	11 36 17
3	0 17 01.518 27.315	0 27 20.06 173.57	7.11	.84	.488 685 2 687	11 32 48
4	0 17 28.833 27.274	0 24 26.49 173.07	7.11	.84	.485 998 2 934	11 29 19
5	0 17 56.107 27.230	0 21 33.42 172.57	7.11	.84	.483 064 3 181	11 25 51
6	0 18 23.337 +27.181	- 0 18 40.85 +172.02	7.12	0.84	10.479 883 - 3 427	11 22 22
7	0 18 50.518 27.128	0 15 48.83 171.46	7.12	.84	.476 456 3 671	11 18 53
8	0 19 17.646 27.073	0 12 57.37 170.87	7.12	.84	.472 785 3 916	11 15 24
9	0 19 44.719 27.014	0 10 06.50 170.26	7.12	.84	.468 869 4 158	11 11 55
10	0 20 11.733 26.951	0 07 16.24 169.62	7.13	.84	.464 711 4 401	11 08 26
11	0 20 38.684 +26.886	- 0 04 26.62 +168.97	7.13	0.84	10.460 310 - 4 642	11 04 57
12	0 21 05.570 26.815	- 0 01 37.65 168.28	7.13	.84	.455 668 4 882	11 01 27
13	0 21 32.385 26.742	+ 0 01 10.63 167.58	7.14	.84	.450 786 5 120	10 57 58
14	0 21 59.127 26.663	0 03 58.21 166.83	7.14	.84	.445 666 5 357	10 54 29
15	0 22 25.790 26.581	0 06 45.04 166.07	7.14	.84	.440 309 5 592	10 50 59
16	0 22 52.371 +26.491	+ 0 09 31.11 +165.27	7.15	0.84	10.434 717 - 5 826	10 47 30
17	0 23 18.862 26.399	0 12 16.38 164.43	7.15	.84	.428 891 6 058	10 44 00
18	0 23 45.261 26.301	0 15 00.81 163.57	7.15	.84	.422 833 6 288	10 40 31
19	0 24 11.562 26.197	0 17 44.38 162.67	7.16	.84	.416 545 6 517	10 37 01
20	0 24 37.759 26.091	0 20 27.05 161.75	7.16	.85	.410 028 6 743	10 33 31
21	0 25 03.850 +25.982	+ 0 23 08.80 +160.80	7.17	0.85	10.403 285 - 6 969	10 30 01
22	0 25 29.832 25.869	0 25 49.60 159.84	7.17	.85	.396 316 7 191	10 26 31
23	0 25 55.701 25.757	0 28 29.44 158.89	7.18	.85	.389 125 7 413	10 23 01
24	0 26 21.458 25.643	0 31 08.33 157.92	7.18	.85	.381 712 7 634	10 19 30
25	0 26 47.101 25.528	0 33 46.25 156.93	7.19	.85	.374 078 7 851	10 16 00
26	0 27 12.629 +25.406	+ 0 36 23.18 +155.93	7.19	0.85	10.366 227 - 8 069	10 12 29
27	0 27 38.035 25.282	0 38 59.11 154.90	7.20	.85	.358 158 8 284	10 08 59
28	0 28 03.317 25.151	0 41 34.01 153.83	7.20	.85	.349 874 8 499	10 05 28
29	0 28 28.468 25.014	0 44 07.84 152.73	7.21	.85	.341 375 8 711	10 01 57
30	0 28 53.482 24.873	0 46 40.57 151.59	7.22	.85	.332 664 8 923	9 58 26
May 1	0 29 18.355 +24.729	+ 0 49 12.16 +150.43	7.22	0.85	10.323 741 - 9 133	9 54 55
2	0 29 43.084 24.578	0 51 42.59 149.25	7.23	.85	.314 608 9 340	9 51 23
3	0 30 07.662 24.425	0 54 11.84 148.02	7.24	.85	.305 268 9 546	9 47 52
4	0 30 32.087 24.268	0 56 39.86 146.79	7.24	.85	.295 722 9 751	9 44 20
5	0 30 56.355 24.108	0 59 06.65 145.53	7.25	.86	.285 971 9 952	9 40 48
6	0 31 20.463 +23.946	+ 1 01 32.18 +144.26	7.26	0.86	10.276 019 - 10 152	9 37 16
7	0 31 44.409 23.779	1 03 56.44 142.96	7.26	.86	.265 867 10 350	9 33 44
8	0 32 08.188 23.609	1 06 19.40 141.64	7.27	.86	.255 517 10 545	9 30 12
9	0 32 31.797 23.436	1 08 41.04 140.29	7.28	.86	.244 972 10 738	9 26 39
10	0 32 55.233 23.259	1 11 01.33 138.94	7.29	.86	.234 234 10 928	9 23 06
11	0 33 18.492 +23.077	+ 1 13 20.27 +137.55	7.29	0.86	10.223 306 - 11 116	9 19 34
12	0 33 41.569 22.892	1 15 37.82 136.13	7.30	.86	.212 190 11 301	9 16 01
13	0 34 04.461 22.701	1 17 53.95 134.69	7.31	.86	.200 889 11 483	9 12 27
14	0 34 27.162 22.504	1 20 08.64 133.21	7.32	.86	.189 406 11 663	9 08 54
15	0 34 49.666 22.304	1 22 21.85 131.71	7.33	.86	.177 743 11 839	9 05 20
16	0 35 11.970 +22.099	+ 1 24 33.56 +130.17	7.34	0.87	10.165 904 - 12 012	9 01 47
17	0 35 34.069	+ 1 26 43.73	7.34	0.87	10.153 892	8 58 13

SATURN, 1967

FOR 0^h EPHEMERIS TIME

213

Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
May 17	0 35 34.069	+ 1 26 43.73	7.34	0.87	10.153 892	8 58 13
18	0 35 55.958	1 28 52.35	7.35	.87	10.141 709	8 54 38
19	0 36 17.636	1 30 59.39	7.36	.87	10.129 358	8 51 04
20	0 36 39.100	1 33 04.84	7.37	.87	10.116 843	8 47 29
21	0 37 00.348	1 35 08.69	7.38	.87	10.104 165	8 43 54
22	0 37 21.380	+ 1 37 10.96	7.39	0.87	10.091 329	8 40 19
23	0 37 42.193	1 39 11.61	7.40	.87	10.078 336	8 36 44
24	0 38 02.785	1 41 10.64	7.41	.87	10.065 190	8 33 09
25	0 38 23.152	1 43 08.03	7.42	.88	10.051 892	8 29 33
26	0 38 43.289	1 45 03.75	7.43	.88	10.038 445	8 25 57
27	0 39 03.190	+ 1 46 57.77	7.44	0.88	10.024 853	8 22 21
28	0 39 22.849	1 48 50.07	7.45	.88	10.011 117	8 18 44
29	0 39 42.264	1 50 40.61	7.46	.88	9.997 239	8 15 08
30	0 40 01.429	1 52 29.35	7.47	.88	9.983 224	8 11 31
31	0 40 20.341	1 54 16.30	7.48	.88	9.969 074	8 07 53
June 1	0 40 38.998	+ 1 56 01.43	7.49	0.88	9.954 791	8 04 16
2	0 40 57.396	1 57 44.71	7.50	.89	9.940 379	8 00 38
3	0 41 15.532	1 59 26.14	7.51	.89	9.925 842	7 57 00
4	0 41 33.403	2 01 05.70	7.52	.89	9.911 182	7 53 22
5	0 41 51.007	2 02 43.37	7.54	.89	9.896 402	7 49 44
6	0 42 08.341	+ 2 04 19.13	7.55	0.89	9.881 507	7 46 05
7	0 42 25.400	2 05 52.97	7.56	.89	9.866 499	7 42 26
8	0 42 42.182	2 07 24.88	7.57	.89	9.851 383	7 38 47
9	0 42 58.681	2 08 54.81	7.58	.89	9.836 161	7 35 07
10	0 43 14.895	2 10 22.75	7.59	.90	9.820 839	7 31 27
11	0 43 30.816	+ 2 11 48.68	7.60	0.90	9.805 419	7 27 47
12	0 43 46.442	2 13 12.58	7.62	.90	9.789 906	7 24 06
13	0 44 01.769	2 14 34.40	7.63	.90	9.774 304	7 20 26
14	0 44 16.792	2 15 54.14	7.64	.90	9.758 616	7 16 45
15	0 44 31.509	2 17 11.79	7.65	.90	9.742 846	7 13 03
16	0 44 45.919	+ 2 18 27.32	7.67	0.90	9.726 999	7 09 22
17	0 45 00.021	2 19 40.75	7.68	.91	9.711 079	7 05 40
18	0 45 13.814	2 20 52.07	7.69	.91	9.695 088	7 01 57
19	0 45 27.296	2 22 01.28	7.70	.91	9.679 031	6 58 15
20	0 45 40.467	2 23 08.37	7.72	.91	9.662 912	6 54 32
21	0 45 53.323	+ 2 24 13.35	7.73	0.91	9.646 734	6 50 49
22	0 46 05.860	2 25 16.18	7.74	.91	9.630 500	6 47 05
23	0 46 18.074	2 26 16.85	7.76	.92	9.614 214	6 43 21
24	0 46 29.960	2 27 15.33	7.77	.92	9.597 880	6 39 37
25	0 46 41.516	2 28 11.60	7.78	.92	9.581 501	6 35 53
26	0 46 52.736	+ 2 29 05.64	7.80	0.92	9.565 081	6 32 08
27	0 47 03.619	2 29 57.43	7.81	.92	9.548 623	6 28 23
28	0 47 14.162	2 30 46.97	7.82	.92	9.532 132	6 24 37
29	0 47 24.363	2 31 34.24	7.84	.92	9.515 610	6 20 51
30	0 47 34.221	2 32 19.24	7.85	.93	9.499 064	6 17 05
July 1	0 47 43.733	+ 2 33 01.96	7.86	0.93	9.482 495	6 13 18
2	0 47 52.898	+ 2 33 42.38	7.88	0.93	9.465 910	6 09 32

SATURN, 1967

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
July	^{h m s} 0 47 43.733 + 9.165	^{° ′ ″} + 2 33 01.96 + 40.42	[″] 7.86	[″] 0.93	9.482 495 -16 585	^{h m s} 6 13 18
	0 47 52.898 8.817	2 33 42.38 38.13	7.88	.93	.465 910 16 599	6 09 32
	0 48 01.715 8.464	2 34 20.51 35.82	7.89	.93	.449 311 16 608	6 05 44
	0 48 10.179 8.111	2 34 56.33 33.52	7.91	.93	.432 703 16 612	6 01 57
	0 48 18.290 7.754	2 35 29.85 31.18	7.92	.93	.416 091 16 611	5 58 09
	0 48 26.044 + 7.394	+ 2 36 01.03 + 28.85	7.93	0.94	9.399 480 -16 607	5 54 21
	0 48 33.438 7.032	2 36 29.88 26.50	7.95	.94	.382 873 16 598	5 50 32
	0 48 40.470 6.665	2 36 56.38 24.12	7.96	.94	.366 275 16 583	5 46 43
	0 48 47.135 6.296	2 37 20.50 21.74	7.98	.94	.349 692 16 565	5 42 53
	0 48 53.431 5.925	2 37 42.24 19.34	7.99	.94	.333 127 16 541	5 39 04
	0 48 59.356 + 5.553	+ 2 38 01.58 + 16.95	8.00	0.94	9.316 586 -16 513	5 35 14
	0 49 04.909 5.181	2 38 18.53 14.55	8.02	.95	.300 073 16 479	5 31 23
	0 49 10.090 4.809	2 38 33.08 12.17	8.03	.95	.283 594 16 443	5 27 32
	0 49 14.899 4.438	2 38 45.25 9.79	8.05	.95	.267 151 16 400	5 23 41
	0 49 19.337 4.069	2 38 55.04 7.43	8.06	.95	.250 751 16 354	5 19 50
	0 49 23.406 + 3.699	+ 2 39 02.47 + 5.09	8.08	0.95	9.234 397 -16 303	5 15 58
	0 49 27.105 3.328	2 39 07.56 2.73	8.09	.95	.218 094 16 248	5 12 05
	0 49 30.433 2.957	2 39 10.29 + 0.39	8.10	.96	.201 846 16 190	5 08 13
	0 49 33.390 2.583	2 39 10.68 - 1.97	8.12	.96	.185 656 16 126	5 04 20
	0 49 35.973 2.208	2 39 08.71 4.32	8.13	.96	.169 530 16 058	5 00 26
	0 49 38.181 + 1.829	+ 2 39 04.39 - 6.69	8.15	0.96	9.153 472 -15 987	4 56 32
	0 49 40.010 1.450	2 38 57.70 9.07	8.16	.96	.137 485 15 912	4 52 38
	0 49 41.460 1.071	2 38 48.63 11.45	8.18	.96	.121 573 15 832	4 48 44
	0 49 42.531 0.690	2 38 37.18 13.81	8.19	.97	.105 741 15 748	4 44 49
	0 49 43.221 + 0.311	2 38 23.37 16.18	8.20	.97	.089 993 15 660	4 40 53
	0 49 43.532 - 0.068	+ 2 38 07.19 - 18.55	8.22	0.97	9.074 333 -15 566	4 36 58
	0 49 43.464 0.447	2 37 48.64 20.89	8.23	.97	.058 767 15 470	4 33 02
	0 49 43.017 0.823	2 37 27.75 23.23	8.25	.97	.043 297 15 367	4 29 05
	0 49 42.194 1.200	2 37 04.52 25.55	8.26	.97	.027 930 15 262	4 25 08
	0 49 40.994 1.576	2 36 38.97 27.87	8.27	.98	9.012 668 15 150	4 21 11
	0 49 39.418 - 1.952	+ 2 36 11.10 - 30.18	8.29	0.98	8.997 518 -15 034	4 17 14
Aug.	0 49 37.466 2.326	2 35 40.92 32.48	8.30	.98	.982 484 14 914	4 13 16
	0 49 35.140 2.702	2 35 08.44 34.76	8.32	.98	.967 570 14 789	4 09 18
	0 49 32.438 3.076	2 34 33.68 37.05	8.33	.98	.952 781 14 659	4 05 19
	0 49 29.362 3.452	2 33 56.63 39.34	8.34	.98	.938 122 14 523	4 01 20
	0 49 25.910 - 3.827	+ 2 33 17.29 - 41.60	8.36	0.99	8.923 599 -14 384	3 57 20
	0 49 22.083 4.201	2 32 35.69 43.87	8.37	.99	.909 215 14 240	3 53 21
	0 49 17.882 4.575	2 31 51.82 46.12	8.38	.99	.894 975 14 089	3 49 20
	0 49 13.307 4.943	2 31 05.70 48.35	8.40	.99	.880 886 13 936	3 45 20
	0 49 08.364 5.308	2 30 17.35 50.55	8.41	.99	.866 950 13 777	3 41 19
	0 49 03.056 - 5.660	+ 2 29 26.80 - 52.70	8.42	0.99	8.853 173 -13 614	3 37 18
	0 48 57.387 6.026	2 28 34.10 54.83	8.44	1.00	.839 559 13 446	3 33 16
	0 48 51.361 6.376	2 27 39.27 56.91	8.45	.00	.826 113 13 274	3 29 14
	0 48 44.985 6.726	2 26 42.36 58.98	8.46	.00	.812 839 13 099	3 25 12
	0 48 38.259 7.071	2 25 43.38 61.01	8.47	.00	.799 740 12 919	3 21 09
	0 48 31.188 - 7.416	+ 2 24 42.37 - 63.01	8.49	1.00	8.786 821 -12 736	3 17 06
	0 48 23.772	+ 2 23 39.36	8.50	1.00	8.774 085	3 13 03

SATURN, 1967

FOR 0^h EPHEMERIS TIME

215

Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°]	["]		^h ^m ^s
Aug. 16	0 48 23.772 - 7.759	+ 2 23 39.36 - 65.02	8.50	1.00	8.774 085 -12 548	3 13 03
17	0 48 16.013 8.099	2 22 34.34 67.00	8.51	.00	.761 537 12 357	3 08 59
18	0 48 07.914 8.436	2 21 27.34 68.95	8.52	.01	.749 180 12 162	3 04 55
19	0 47 59.478 8.771	2 20 18.39 70.89	8.53	.01	.737 018 11 963	3 00 51
20	0 47 50.707 9.102	2 19 07.50 72.80	8.55	.01	.725 055 11 761	2 56 46
21	0 47 41.605 - 9.428	+ 2 17 54.70 - 74.67	8.56	1.01	8.713 294 -11 555	2 52 41
22	0 47 32.177 9.750	2 16 40.03 76.52	8.57	.01	.701 739 11 345	2 48 36
23	0 47 22.427 10.065	2 15 23.51 78.32	8.58	.01	.690 394 11 131	2 44 30
24	0 47 12.362 10.378	2 14 05.19 80.09	8.59	.01	.679 263 10 914	2 40 24
25	0 47 01.984 10.683	2 12 45.10 81.82	8.60	.02	.668 349 10 692	2 36 18
26	0 46 51.301 -10.984	+ 2 11 23.28 - 83.52	8.61	1.02	8.657 657 -10 466	2 32 12
27	0 46 40.317 11.281	2 09 59.76 85.17	8.62	.02	.647 191 10 237	2 28 05
28	0 46 29.036 11.572	2 08 34.59 86.79	8.63	.02	.636 954 10 005	2 23 58
29	0 46 17.464 11.859	2 07 07.80 88.37	8.64	.02	.626 949 9 767	2 19 50
30	0 46 05.605 12.140	2 05 39.43 89.92	8.65	.02	.617 182 9 527	2 15 42
31	0 45 53.465 -12.418	+ 2 04 09.51 - 91.43	8.66	1.02	8.607 655 -9 283	2 11 34
Sept. 1	0 45 41.047 12.692	2 02 38.08 92.92	8.67	.02	.598 372 9 034	2 07 26
2	0 45 28.355 12.959	2 01 05.16 94.35	8.68	.02	.589 338 8 782	2 03 18
3	0 45 15.396 13.221	1 59 30.81 95.75	8.69	.03	.580 556 8 528	1 59 09
4	0 45 02.175 13.476	1 57 55.06 97.12	8.70	.03	.572 028 8 268	1 55 00
5	0 44 48.699 -13.722	+ 1 56 17.94 - 98.41	8.71	1.03	8.563 760 -8 005	1 50 50
6	0 44 34.977 13.959	1 54 39.53 99.64	8.72	.03	.555 755 7 741	1 46 41
7	0 44 21.018 14.187	1 52 59.89 100.81	8.72	.03	.548 014 7 472	1 42 31
8	0 44 06.831 14.404	1 51 19.08 101.92	8.73	.03	.540 542 7 201	1 38 21
9	0 43 52.427 14.615	1 49 37.16 102.95	8.74	.03	.533 341 6 928	1 34 11
10	0 43 37.812 -14.819	+ 1 47 54.21 -103.95	8.75	1.03	8.526 413 -6 652	1 30 00
11	0 43 22.993 15.015	1 46 10.26 104.88	8.75	.03	.519 761 6 375	1 25 50
12	0 43 07.978 15.207	1 44 25.38 105.79	8.76	.03	.513 386 6 094	1 21 39
13	0 42 52.771 15.390	1 42 39.59 106.64	8.77	.03	.507 292 5 812	1 17 28
14	0 42 37.381 15.568	1 40 52.95 107.45	8.77	.04	.501 480 5 528	1 13 16
15	0 42 21.813 -15.737	+ 1 39 05.50 -108.21	8.78	1.04	8.495 952 -5 242	1 09 05
16	0 42 06.076 15.899	1 37 17.29 108.92	8.78	.04	.490 710 4 955	1 04 54
17	0 41 50.177 16.053	1 35 28.37 109.58	8.79	.04	.485 755 4 666	1 00 42
18	0 41 34.124 16.197	1 33 38.79 110.17	8.79	.04	.481 089 4 374	0 56 30
19	0 41 17.927 16.333	1 31 48.62 110.70	8.80	.04	.476 715 4 082	0 52 18
20	0 41 01.594 -16.459	+ 1 29 57.92 -111.18	8.80	1.04	8.472 633 -3 787	0 48 06
21	0 40 45.135 16.576	1 28 06.74 111.60	8.81	.04	.468 846 3 491	0 43 53
22	0 40 28.559 16.684	1 26 15.14 111.94	8.81	.04	.465 355 3 194	0 39 41
23	0 40 11.875 16.784	1 24 23.20 112.25	8.81	.04	.462 161 2 894	0 35 29
24	0 39 55.091 16.875	1 22 30.95 112.48	8.82	.04	.459 267 2 594	0 31 16
25	0 39 38.216 -16.957	+ 1 20 38.47 -112.65	8.82	1.04	8.456 673 -2 291	0 27 03
26	0 39 21.259 17.032	1 18 45.82 112.79	8.82	.04	.454 382 1 989	0 22 51
27	0 39 04.227 17.098	1 16 53.03 112.85	8.82	.04	.452 393 1 684	0 18 38
28	0 38 47.129 17.157	1 15 00.18 112.87	8.82	.04	.450 709 1 378	0 14 25
29	0 38 29.972 17.206	1 13 07.31 112.84	8.83	.04	.449 331 1 071	0 10 12
30	0 38 12.766 -17.248	+ 1 11 14.47 -112.75	8.83	1.04	8.448 260 -764	0 05 59
Oct. 1	0 37 55.518	+ 1 09 21.72	8.83	1.04	8.447 496	{ 0 01 46 } { 23 57 33 }

SATURN, 1967
FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension			Apparent Declination			Polar S.D.	Hor. Par.	True Distance from the Earth			Ephem- eris Transit
	^h ^m ^s		^s	[°] ['] ["]		["]	["]	["]				^h ^m ^s
Oct.	1	0 37 55.518	-17.280	+ 1 09 21.72	-112.59	8.83	1.04	8.447 496	-	455	{ 0 01 46 }	
	2	0 37 38.238	17.301	1 07 29.13	112.39	8.83	.04	.447 041	-	146	{ 23 57 33 }	
	3	0 37 20.937	17.310	1 05 36.74	112.08	8.83	.04	.446 895	+	163	23 53 20	
	4	0 37 03.627	17.307	1 03 44.66	111.71	8.83	.04	.447 058		473	23 49 06	
	5	0 36 46.320	17.293	1 01 52.95	111.25	8.83	.04	.447 531		783	23 44 53	
	6	0 36 29.027	-17.268	+ 1 00 01.70	-110.74	8.83	1.04	8.448 314	+	1 092	23 40 40	
	7	0 36 11.759	17.232	0 58 10.96	110.13	8.83	.04	.449 406		1 401	23 36 27	
	8	0 35 54.527	17.189	0 56 20.83	109.50	8.82	.04	.450 807		1 708	23 32 14	
	9	0 35 37.338	17.137	0 54 31.33	108.79	8.82	.04	.452 515		2 016	23 28 01	
	10	0 35 20.201	17.078	0 52 42.54	108.05	8.82	.04	.454 531		2 321	23 23 48	
	11	0 35 03.123	-17.012	+ 0 50 54.49	-107.25	8.82	1.04	8.456 852	+	2 626	23 19 35	
	12	0 34 46.111	16.935	0 49 07.24	106.40	8.81	.04	.459 478		2 930	23 15 22	
	13	0 34 29.176	16.850	0 47 20.84	105.50	8.81	.04	.462 408		3 232	23 11 10	
	14	0 34 12.326	16.756	0 45 35.34	104.54	8.81	.04	.465 640		3 533	23 06 57	
	15	0 33 55.570	16.652	0 43 50.80	103.52	8.80	.04	.469 173		3 832	23 02 44	
	16	0 33 38.918	-16.539	+ 0 42 07.28	-102.44	8.80	1.04	8.473 005	+	4 131	22 58 32	
	17	0 33 22.379	16.415	0 40 24.84	101.30	8.80	.04	.477 136		4 428	22 54 20	
	18	0 33 05.964	16.283	0 38 43.54	100.11	8.79	.04	.481 564		4 724	22 50 07	
	19	0 32 49.681	16.140	0 37 03.43	98.85	8.79	.04	.486 288		5 017	22 45 55	
	20	0 32 33.541	15.991	0 35 24.58	97.55	8.78	.04	.491 305		5 309	22 41 43	
	21	0 32 17.550	-15.831	+ 0 33 47.03	-96.19	8.78	1.04	8.496 614	+	5 599	22 37 31	
	22	0 32 01.719	15.665	0 32 10.84	94.77	8.77	.04	.502 213		5 889	22 33 20	
	23	0 31 46.054	15.489	0 30 36.07	93.33	8.76	.03	.508 102		6 175	22 29 08	
	24	0 31 30.565	15.308	0 29 02.74	91.82	8.76	.03	.514 277		6 460	22 24 57	
	25	0 31 15.257	15.118	0 27 30.92	90.29	8.75	.03	.520 737		6 743	22 20 46	
	26	0 31 00.139	-14.921	+ 0 26 00.63	-88.70	8.74	1.03	8.527 480	+	7 025	22 16 35	
	27	0 30 45.218	14.718	0 24 31.93	87.06	8.74	.03	.534 505		7 393	22 12 24	
	28	0 30 30.500	14.506	0 23 04.87	85.40	8.73	.03	.541 808		7 579	22 08 14	
	29	0 30 15.994	14.285	0 21 39.47	83.66	8.72	.03	.549 387		7 853	22 04 03	
	30	0 30 01.709	14.056	0 20 15.81	81.89	8.71	.03	.557 240		8 125	21 59 53	
Nov.	31	0 29 47.653	-13.816	+ 0 18 53.92	-80.05	8.71	1.03	8.565 365	+	8 393	21 55 43	
	1	0 29 33.837	13.567	0 17 33.87	78.14	8.70	.03	.573 758		8 659	21 51 34	
	2	0 29 20.270	13.306	0 16 15.73	76.18	8.69	.03	.582 417		8 920	21 47 24	
	3	0 29 06.964	13.040	0 14 59.55	74.18	8.68	.02	.591 337		9 180	21 43 15	
	4	0 28 53.924	12.766	0 13 45.37	72.12	8.67	.02	.600 517		9 434	21 39 06	
	5	0 28 41.158	-12.488	+ 0 12 33.25	-70.04	8.66	1.02	8.609 951	+	9 686	21 34 57	
	6	0 28 28.670	12.204	0 11 23.21	67.94	8.65	.02	.619 637		9 932	21 30 49	
	7	0 28 16.466	11.916	0 10 15.27	65.82	8.64	.02	.629 569		10 176	21 26 41	
	8	0 28 04.550	11.624	0 09 09.45	63.66	8.63	.02	.639 745		10 415	21 22 33	
	9	0 27 52.926	11.324	0 08 05.79	61.48	8.62	.02	.650 160		10 650	21 18 26	
	10	0 27 41.602	-11.019	+ 0 07 04.31	-59.26	8.61	1.02	8.660 810	+	10 881	21 14 18	
	11	0 27 30.583	10.708	0 06 05.05	57.01	8.60	.01	.671 691		11 108	21 10 12	
	12	0 27 19.875	10.391	0 05 08.04	54.74	8.59	.01	.682 799		11 331	21 06 05	
	13	0 27 09.484	10.066	0 04 13.30	52.42	8.58	.01	.694 130		11 550	21 01 59	
	14	0 26 59.418	9.738	0 03 20.88	50.08	8.57	.01	.705 680		11 765	20 57 53	
	15	0 26 49.680	-9.404	+ 0 02 30.80	-47.70	8.55	1.01	8.717 445	+	11 976	20 53 47	
16	0 26 40.276		+ 0 01 43.10		8.54	1.01	8.729 421			20 49 42		

SATURN, 1967

FOR 0^h EPHEMERIS TIME

217

Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°] ['] ["]	[°] ['] ["]		^h ^m ^s
Nov. 16	0 26 40.276 - 9.064	+ 0 01 43.10 - 45.31	8.54	1.01	8.729 421 +12 182	20 45 37
17	0 26 31.212 - 8.720	0 00 57.79 - 42.89	8.53	.01	.741 603 12 385	20 41 32
18	0 26 22.492 - 8.373	+ 0 00 14.90 - 40.46	8.52	.01	.753 988 12 583	20 37 28
19	0 26 14.119 - 8.021	- 0 00 25.56 - 37.99	8.51	.00	.766 571 12 778	20 33 24
20	0 26 06.098 - 7.668	0 01 03.55 - 35.53	8.49	.00	.779 349 12 968	20 29 20
21	0 25 58.430 - 7.309	- 0 01 39.08 - 33.04	8.48	1.00	8.792 317 +13 154	20 25 17
22	0 25 51.121 - 6.950	0 02 12.12 - 30.54	8.47	.00	.805 471 13 336	20 21 14
23	0 25 44.171 - 6.587	0 02 42.66 - 28.05	8.46	.00	.818 807 13 514	20 17 12
24	0 25 37.584 - 6.221	0 03 10.71 - 25.52	8.44	1.00	.832 321 13 686	20 13 10
25	0 25 31.363 - 5.852	0 03 36.23 - 22.99	8.43	0.99	.846 007 13 855	20 09 08
26	0 25 25.511 - 5.477	- 0 03 59.22 - 20.43	8.42	0.99	8.859 862 +14 020	20 05 06
27	0 25 20.034 - 5.099	0 04 19.65 - 17.85	8.40	.99	.873 882 14 178	20 01 05
28	0 25 14.935 - 4.713	0 04 37.50 - 15.24	8.39	.99	.888 060 14 334	19 57 05
29	0 25 10.222 - 4.326	0 04 52.74 - 12.60	8.38	.99	.902 394 14 484	19 53 04
30	0 25 05.896 - 3.933	0 05 05.34 - 9.95	8.36	.99	.916 878 14 628	19 49 05
Dec. 1	0 25 01.963 - 3.538	- 0 05 15.29 - 7.28	8.35	0.99	8.931 506 +14 767	19 45 05
2	0 24 58.425 - 3.142	0 05 22.57 - 4.62	8.34	.98	.946 273 14 901	19 41 06
3	0 24 55.283 - 2.747	0 05 27.19 - 1.96	8.32	.98	.961 174 15 030	19 37 07
4	0 24 52.536 - 2.351	0 05 29.15 + 0.69	8.31	.98	.976 204 15 153	19 33 09
5	0 24 50.185 - 1.958	0 05 28.46 + 3.34	8.29	.98	8.991 357 15 271	19 29 11
6	0 24 48.227 - 1.561	- 0 05 25.12 + 5.96	8.28	0.98	9.006 628 +15 383	19 25 13
7	0 24 46.666 - 1.165	0 05 19.16 + 8.60	8.27	.98	.022 011 15 490	19 21 16
8	0 24 45.501 - 0.767	0 05 10.56 + 11.24	8.25	.97	.037 501 15 592	19 17 20
9	0 24 44.734 - 0.368	0 04 59.32 + 13.87	8.24	.97	.053 093 15 688	19 13 23
10	0 24 44.366 + 0.034	0 04 45.45 + 16.52	8.22	.97	.068 781 15 780	19 09 27
11	0 24 44.400 + 0.434	- 0 04 28.93 + 19.15	8.21	0.97	9.084 561 +15 866	19 05 32
12	0 24 44.834 + 0.837	0 04 09.78 + 21.78	8.19	.97	.100 427 15 948	19 01 36
13	0 24 45.671 + 1.240	0 03 48.00 + 24.42	8.18	.97	.116 375 16 024	18 57 42
14	0 24 46.911 + 1.642	0 03 23.58 + 27.04	8.17	.96	.132 399 16 096	18 53 47
15	0 24 48.553 + 2.045	0 02 56.54 + 29.66	8.15	.96	.148 495 16 163	18 49 53
16	0 24 50.598 + 2.445	- 0 02 26.88 + 32.26	8.14	0.96	9.164 658 +16 224	18 46 00
17	0 24 53.043 + 2.844	0 01 54.62 + 34.86	8.12	.96	.180 882 16 282	18 42 07
18	0 24 55.887 + 3.243	0 01 19.76 + 37.42	8.11	.96	.197 164 16 333	18 38 14
19	0 24 59.130 + 3.639	0 00 42.34 + 39.98	8.09	.96	.213 497 16 381	18 34 21
20	0 25 02.769 + 4.032	- 0 00 02.36 + 42.52	8.08	.95	.229 878 16 425	18 30 29
21	0 25 06.801 + 4.427	+ 0 00 40.16 + 45.03	8.06	0.95	9.246 303 +16 462	18 26 38
22	0 25 11.228 + 4.818	0 01 25.19 + 47.56	8.05	.95	.262 765 16 495	18 22 47
23	0 25 16.046 + 5.212	0 02 12.75 + 50.05	8.04	.95	.279 260 16 524	18 18 56
24	0 25 21.258 + 5.603	0 03 02.80 + 52.57	8.02	.95	.295 784 16 548	18 15 05
25	0 25 26.861 + 5.998	0 03 55.37 + 55.07	8.01	.94	.312 332 16 567	18 11 15
26	0 25 32.859 + 6.391	+ 0 04 50.44 + 57.57	7.99	0.94	9.328 899 +16 580	18 07 26
27	0 25 39.250 + 6.786	0 05 48.01 + 60.06	7.98	.94	.345 479 16 588	18 03 36
28	0 25 46.036 + 7.178	0 06 48.07 + 62.55	7.97	.94	.362 067 16 592	17 59 48
29	0 25 53.214 + 7.569	0 07 50.62 + 65.03	7.95	.94	.378 659 16 590	17 55 59
30	0 26 00.783 + 7.956	0 08 55.65 + 67.47	7.94	.94	.395 249 16 583	17 52 11
31	0 26 08.739 + 8.339	+ 0 10 03.12 + 69.88	7.92	0.93	9.411 832 +16 570	17 48 23
32	0 26 17.078 + 8.720	+ 0 11 13.00 + 71.91	7.91	0.93	9.428 402 +16 570	17 44 36

URANUS, 1967

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension			Apparent Declination			Semi- diam- eter	Hor. Par.	True Distance from the Earth		Ephem- eris Transit
	h	m	s	°	'	"	"	"			h m s
Jan. 0	11	40	45.907	-	0.184	+ 2 55 43.33	1.90	0.49	18.01593	-1667	5 04 03
1	11	40	45.723	0.395	2 55 47.26	3.93	.90	.49	17.99926	1659	5 00 07
2	11	40	45.328	0.604	2 55 52.54	5.28	.91	.49	.98267	1650	4 56 10
3	11	40	44.724	0.812	2 55 59.17	6.63	.91	.49	.96617	1642	4 52 14
4	11	40	43.912	1.017	2 56 07.12	7.95	.91	.49	.94975	1632	4 48 17
5	11	40	42.895	1.222	+ 2 56 16.39	9.27	1.91	0.49	17.93343	-1622	4 44 20
6	11	40	41.673	1.424	2 56 26.96	10.57	.91	.49	.91721	1612	4 40 23
7	11	40	40.249	1.626	2 56 38.83	11.87	.91	.49	.90109	1600	4 36 26
8	11	40	38.623	1.829	2 56 52.00	13.17	.92	.49	.88509	1589	4 32 28
9	11	40	36.794	2.033	2 57 06.47	14.47	.92	.49	.86920	1576	4 28 30
10	11	40	34.761	2.235	+ 2 57 22.24	15.77	1.92	0.49	17.85344	-1564	4 24 32
11	11	40	32.526	2.439	2 57 39.30	17.06	.92	.49	.83780	1550	4 20 34
12	11	40	30.087	2.642	2 57 57.67	18.37	.92	.49	.82230	1537	4 16 36
13	11	40	27.445	2.842	2 58 17.34	19.67	.93	.49	.80693	1522	4 12 37
14	11	40	24.603	3.041	2 58 38.28	20.94	.93	.49	.79171	1507	4 08 38
15	11	40	21.562	3.238	+ 2 59 00.49	22.21	1.93	0.50	17.77664	-1492	4 04 39
16	11	40	18.324	3.433	2 59 23.94	23.45	.93	.50	.76172	1476	4 00 40
17	11	40	14.891	3.623	2 59 48.64	24.70	.93	.50	.74696	1459	3 56 41
18	11	40	11.268	3.813	3 00 14.54	25.90	.93	.50	.73237	1443	3 52 41
19	11	40	07.455	3.997	3 00 41.63	27.09	.93	.50	.71794	1426	3 48 42
20	11	40	03.458	4.182	+ 3 01 09.90	28.27	1.94	0.50	17.70368	-1407	3 44 42
21	11	39	59.276	4.361	3 01 39.32	29.42	.94	.50	.68961	1390	3 40 41
22	11	39	54.915	4.541	3 02 09.88	30.56	.94	.50	.67571	1371	3 36 41
23	11	39	50.374	4.718	3 02 41.58	31.70	.94	.50	.66200	1352	3 32 41
24	11	39	45.656	4.894	3 03 14.38	32.80	.94	.50	.64848	1332	3 28 40
25	11	39	40.762	5.071	+ 3 03 48.29	33.91	1.94	0.50	17.63516	-1313	3 24 39
26	11	39	35.691	5.245	3 04 23.31	35.02	.95	.50	.62203	1292	3 20 38
27	11	39	30.446	5.419	3 04 59.43	36.12	.95	.50	.60911	1272	3 16 37
28	11	39	25.027	5.591	3 05 36.64	37.21	.95	.50	.59639	1251	3 12 36
29	11	39	19.436	5.760	3 06 14.92	38.28	.95	.50	.58388	1229	3 08 34
30	11	39	13.676	5.924	+ 3 06 54.24	39.32	1.95	0.50	17.57159	-1208	3 04 33
Feb. 1	11	39	07.752	6.084	3 07 34.59	40.35	.95	.50	.55951	1185	3 00 31
2	11	39	01.668	6.240	3 08 15.93	41.34	.95	.50	.54766	1163	2 56 29
3	11	38	55.428	6.394	3 08 58.23	42.30	.95	.50	.53603	1139	2 52 27
4	11	38	49.034	6.544	3 09 41.49	43.26	.96	.50	.52464	1116	2 48 24
5	11	38	42.490	6.692	+ 3 10 25.67	44.18	1.96	0.50	17.51348	-1093	2 44 22
6	11	38	35.798	6.839	3 11 10.78	45.11	.96	.50	.50255	1067	2 40 20
7	11	38	28.959	6.985	3 11 56.79	46.01	.96	.50	.49188	1044	2 36 17
8	11	38	21.974	7.126	3 12 43.70	46.91	.96	.50	.48144	1018	2 32 14
9	11	38	14.848	7.268	3 13 31.49	47.79	.96	.50	.47126	993	2 28 11
10	11	38	07.580	7.403	+ 3 14 20.13	48.64	1.96	0.50	17.46133	-966	2 24 08
11	11	38	00.177	7.537	3 15 09.62	49.49	.96	.50	.45167	941	2 20 04
12	11	37	52.640	7.666	3 15 59.92	50.30	.97	.50	.44226	915	2 16 01
13	11	37	44.974	7.790	3 16 51.00	51.08	.97	.50	.43311	887	2 11 57
14	11	37	37.184	7.910	3 17 42.83	51.83	.97	.51	.42424	861	2 07 54
15	11	37	29.274	8.025	+ 3 18 35.39	52.56	1.97	0.51	17.41563	-833	2 03 50
	11	37	21.249		+ 3 19 28.63	53.24	1.97	0.51	17.40730		1 59 46

URANUS, 1967

FOR 0^h EPHEMERIS TIME

219

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Feb. 15	11 37 21.249 - 8.136	+ 3 19 28.63 + 53.90	1.97	0.51	17.40730 - 806	1 59 46
16	11 37 13.113 8.241	3 20 22.53 54.54	.97	.51	.39924 778	1 55 42
17	11 37 04.872 8.343	3 21 17.07 55.13	.97	.51	.39146 750	1 51 38
18	11 36 56.529 8.440	3 22 12.20 55.70	.97	.51	.38396 721	1 47 34
19	11 36 48.089 8.535	3 23 07.90 56.26	.97	.51	.37675 693	1 43 29
20	11 36 39.554 - 8.625	+ 3 24 04.16 + 56.79	1.97	0.51	17.36982 - 665	1 39 25
21	11 36 30.929 8.714	3 25 00.95 57.31	.97	.51	.36317 635	1 35 21
22	11 36 22.215 8.801	3 25 58.26 57.80	.98	.51	.35682 607	1 31 16
23	11 36 13.414 8.884	3 26 56.06 58.29	.98	.51	.35075 578	1 27 11
24	11 36 04.530 8.964	3 27 54.35 58.75	.98	.51	.34497 548	1 23 07
25	11 35 55.566 - 9.042	+ 3 28 53.10 + 59.18	1.98	0.51	17.33949 - 519	1 19 02
26	11 35 46.524 9.112	3 29 52.28 59.57	.98	.51	.33430 489	1 14 57
27	11 35 37.412 9.177	3 30 51.85 59.93	.98	.51	.32941 460	1 10 52
28	11 35 28.235 9.236	3 31 51.78 60.24	.98	.51	.32481 429	1 06 47
Mar. 1	11 35 18.999 9.291	3 32 52.02 60.53	.98	.51	.32052 400	1 02 42
2	11 35 09.708 - 9.341	+ 3 33 52.55 + 60.80	1.98	0.51	17.31652 - 369	0 58 37
3	11 35 00.367 9.389	3 34 53.35 61.05	.98	.51	.31283 339	0 54 31
4	11 34 50.978 9.433	3 35 54.40 61.27	.98	.51	.30944 309	0 50 26
5	11 34 41.545 9.474	3 36 55.67 61.48	.98	.51	.30635 278	0 46 21
6	11 34 32.071 9.513	3 37 57.15 61.66	.98	.51	.30357 247	0 42 15
7	11 34 22.558 - 9.547	+ 3 38 58.81 + 61.84	1.98	0.51	17.30110 - 216	0 38 10
8	11 34 13.011 9.577	3 40 00.65 61.96	.98	.51	.29894 186	0 34 05
9	11 34 03.434 9.603	3 41 02.61 62.06	.98	.51	.29708 154	0 29 59
10	11 33 53.831 9.623	3 42 04.67 62.14	.98	.51	.29554 124	0 25 54
11	11 33 44.208 9.639	3 43 06.81 62.17	.98	.51	.29430 92	0 21 48
12	11 33 34.569 - 9.648	+ 3 44 08.98 + 62.16	1.98	0.51	17.29338 - 62	0 17 43
13	11 33 24.921 9.653	3 45 11.14 62.13	.98	.51	.29276 30	0 13 37
14	11 33 15.268 9.652	3 46 13.27 62.06	.98	.51	.29246 0	0 09 32
15	11 33 05.616 9.646	3 47 15.33 61.95	.98	.51	.29246 + 32	0 05 26
16	11 32 55.970 9.635	3 48 17.28 61.82	.98	.51	.29278 62	{ 0 01 21 } { 23 57 15 }
17	11 32 46.335 - 9.620	+ 3 49 19.10 + 61.65	1.98	0.51	17.29340 + 93	23 53 10
18	11 32 36.715 9.600	3 50 20.75 61.47	.98	.51	.29433 124	23 49 04
19	11 32 27.115 9.576	3 51 22.22 61.25	.98	.51	.29557 154	23 44 59
20	11 32 17.539 9.551	3 52 23.47 61.02	.98	.51	.29711 185	23 40 54
21	11 32 07.988 9.521	3 53 24.49 60.77	.98	.51	.29896 216	23 36 48
22	11 31 58.467 - 9.489	+ 3 54 25.26 + 60.51	1.98	0.51	17.30112 + 245	23 32 43
23	11 31 48.978 9.454	3 55 25.77 60.21	.98	.51	.30357 276	23 28 38
24	11 31 39.524 9.416	3 56 25.98 59.90	.98	.51	.30633 305	23 24 32
25	11 31 30.108 9.372	3 57 25.88 59.56	.98	.51	.30938 336	23 20 27
26	11 31 20.736 9.323	3 58 25.44 59.17	.98	.51	.31274 365	23 16 22
27	11 31 11.413 - 9.267	+ 3 59 24.61 + 58.74	1.98	0.51	17.31639 + 394	23 12 17
28	11 31 02.146 9.207	4 00 23.35 58.29	.98	.51	.32033 424	23 08 12
29	11 30 52.939 9.142	4 01 21.64 57.82	.98	.51	.32457 454	23 04 07
30	11 30 43.797 9.075	4 02 19.46 57.33	.98	.51	.32911 482	23 00 02
31	11 30 34.722 9.004	4 03 16.79 56.82	.98	.51	.33393 511	22 55 57
Apr. 1	11 30 25.718 - 8.932	+ 4 04 13.61 + 56.30	1.98	0.51	17.33904 + 541	22 51 52
2	11 30 16.786	+ 4 05 09.91	1.98	0.51	17.34445	22 47 47

URANUS, 1967 FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Apr. 1	11 30 25.718 - 8.932	+ 4 04 13.61 + 56.30	1.98	0.51	17.33904 + 541	22 51 52
2	11 30 16.786 - 8.857	4 05 09.91 55.76	.98	.51	.34445 + 568	22 47 47
3	11 30 07.929 - 8.778	4 06 05.67 55.20	.98	.51	.35013 598	22 43 43
4	11 29 59.151 - 8.696	4 07 00.87 54.63	.98	.51	.35611 625	22 39 38
5	11 29 50.455 - 8.610	4 07 55.50 54.01	.97	.51	.36236 654	22 35 34
6	11 29 41.845 - 8.519	+ 4 08 49.51 + 53.38	1.97	0.51	17.36890 + 681	22 31 29
7	11 29 33.326 - 8.425	4 09 42.89 52.72	.97	.51	.37571 709	22 27 25
8	11 29 24.901 - 8.325	4 10 35.61 52.02	.97	.51	.38280 737	22 23 21
9	11 29 16.576 - 8.222	4 11 27.63 51.30	.97	.51	.39017 763	22 19 17
10	11 29 08.354 - 8.112	4 12 18.93 50.54	.97	.51	.39780 790	22 15 13
11	11 29 00.242 - 8.000	+ 4 13 09.47 + 49.76	1.97	0.51	17.40570 + 816	22 11 09
12	11 28 52.242 - 7.883	4 13 59.23 48.97	.97	.51	.41386 843	22 07 05
13	11 28 44.359 - 7.762	4 14 48.20 48.14	.97	.51	.42229 868	22 03 02
14	11 28 36.597 - 7.639	4 15 36.34 47.29	.97	.50	.43097 894	21 58 58
15	11 28 28.958 - 7.513	4 16 23.63 46.44	.97	.50	.43991 919	21 54 55
16	11 28 21.445 - 7.384	+ 4 17 10.07 + 45.58	1.96	0.50	17.44910 + 944	21 50 51
17	11 28 14.061 - 7.254	4 17 55.65 44.68	.96	.50	.45854 968	21 46 48
18	11 28 06.807 - 7.123	4 18 40.33 43.80	.96	.50	.46822 992	21 42 45
19	11 27 59.684 - 6.988	4 19 24.13 42.90	.96	.50	.47814 1016	21 38 42
20	11 27 52.696 - 6.854	4 20 07.03 41.99	.96	.50	.48830 1039	21 34 40
21	11 27 45.842 - 6.714	+ 4 20 49.02 + 41.04	1.96	0.50	17.49869 + 1062	21 30 37
22	11 27 39.128 - 6.572	4 21 30.06 40.08	.96	.50	.50931 1084	21 26 35
23	11 27 32.556 - 6.425	4 22 10.14 39.10	.96	.50	.52015 1107	21 22 32
24	11 27 26.131 - 6.273	4 22 49.24 38.08	.96	.50	.53122 1128	21 18 30
25	11 27 19.858 - 6.118	4 23 27.32 37.04	.95	.50	.54250 1150	21 14 28
26	11 27 13.740 - 5.962	+ 4 24 04.36 + 36.01	1.95	0.50	17.55400 + 1171	21 10 26
27	11 27 07.778 - 5.804	4 24 40.37 34.96	.95	.50	.56571 1192	21 06 25
28	11 27 01.974 - 5.647	4 25 15.33 33.92	.95	.50	.57763 1212	21 02 23
29	11 26 56.327 - 5.486	4 25 49.25 32.87	.95	.50	.58975 1233	20 58 22
30	11 26 50.841 - 5.327	4 26 22.12 31.81	.95	.50	.60208 1252	20 54 20
May 1	11 26 45.514 - 5.165	+ 4 26 53.93 + 30.74	1.95	0.50	17.61460 + 1271	20 50 19
2	11 26 40.349 - 5.001	4 27 24.67 29.67	.94	.50	.62731 1290	20 46 18
3	11 26 35.348 - 4.833	4 27 54.34 28.56	.94	.50	.64021 1309	20 42 18
4	11 26 30.515 - 4.665	4 28 22.90 27.44	.94	.50	.65330 1327	20 38 17
5	11 26 25.850 - 4.491	4 28 50.34 26.32	.94	.50	.66657 1344	20 34 17
6	11 26 21.359 - 4.317	+ 4 29 16.66 + 25.15	1.94	0.50	17.68001 + 1362	20 30 16
7	11 26 17.042 - 4.138	4 29 41.81 23.98	.94	.50	.69363 1378	20 26 16
8	11 26 12.904 - 3.957	4 30 05.79 22.81	.94	.50	.70741 1395	20 22 17
9	11 26 08.947 - 3.774	4 30 28.60 21.60	.93	.50	.72136 1411	20 18 17
10	11 26 05.173 - 3.590	4 30 50.20 20.39	.93	.50	.73547 1426	20 14 17
11	11 26 01.583 - 3.403	+ 4 31 10.59 + 19.18	1.93	0.50	17.74973 + 1441	20 10 18
12	11 25 58.180 - 3.215	4 31 29.77 17.96	.93	.50	.76414 1456	20 06 19
13	11 25 54.965 - 3.029	4 31 47.73 16.75	.93	.49	.77870 1469	20 02 20
14	11 25 51.936 - 2.842	4 32 04.48 15.52	.93	.49	.79339 1483	19 58 21
15	11 25 49.094 - 2.654	4 32 20.00 14.31	.92	.49	.80822 1496	19 54 23
16	11 25 46.440 - 2.467	+ 4 32 34.31 + 13.10	1.92	0.49	17.82318 + 1508	19 50 24
17	11 25 43.973 - 2.280	+ 4 32 47.41 + 11.89	1.92	0.49	17.83826 + 1521	19 46 26

URANUS, 1967

221

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
May 17	11 25 43.973 - 2.279	+ 4 32 47.41 + 11.87	1.92	0.49	17.83826 +1521	19 46 26
18	11 25 41.694 2.091	4 32 59.28 10.65	.92	.49	.85347 1532	19 42 28
19	11 25 39.603 1.901	4 33 09.93 9.42	.92	.49	.86879 1543	19 38 30
20	11 25 37.702 1.709	4 33 19.35 8.16	.92	.49	.88422 1553	19 34 32
21	11 25 35.993 1.514	4 33 27.51 6.90	.92	.49	.89975 1564	19 30 35
22	11 25 34.479 - 1.317	+ 4 33 34.41 + 5.62	1.91	0.49	17.91539 +1573	19 26 38
23	11 25 33.162 1.120	4 33 40.03 4.35	.91	.49	.93112 1583	19 22 41
24	11 25 32.042 0.923	4 33 44.38 3.09	.91	.49	.94695 1592	19 18 44
25	11 25 31.119 0.727	4 33 47.47 1.82	.91	.49	.96287 1600	19 14 47
26	11 25 30.392 0.532	4 33 49.29 + 0.59	.91	.49	.97887 1608	19 10 51
27	11 25 29.860 - 0.339	+ 4 33 49.88 - 0.67	1.90	0.49	17.99495 +1615	19 06 54
28	11 25 29.521 - 0.146	4 33 49.21 1.90	.90	.49	18.01110 1623	19 02 58
29	11 25 29.375 + 0.048	4 33 47.31 3.14	.90	.49	.02733 1629	18 59 02
30	11 25 29.423 0.241	4 33 44.17 4.38	.90	.49	.04362 1636	18 55 07
31	11 25 29.664 0.437	4 33 39.79 5.64	.90	.49	.05998 1641	18 51 11
June 1	11 25 30.101 + 0.633	+ 4 33 34.15 - 6.90	1.90	0.49	18.07639 +1647	18 47 16
2	11 25 30.734 0.830	4 33 27.25 8.17	.89	.49	.09286 1651	18 43 21
3	11 25 31.564 1.028	4 33 19.08 9.44	.89	.49	.10937 1656	18 39 26
4	11 25 32.592 1.228	4 33 09.64 10.72	.89	.49	.12593 1660	18 35 31
5	11 25 33.820 1.427	4 32 58.92 12.00	.89	.49	.14253 1663	18 31 36
6	11 25 35.247 + 1.628	+ 4 32 46.92 - 13.29	1.89	0.48	18.15916 +1666	18 27 42
7	11 25 36.875 1.828	4 32 33.63 14.56	.89	.48	.17582 1668	18 23 48
8	11 25 38.703 2.027	4 32 19.07 15.83	.88	.48	.19250 1670	18 19 54
9	11 25 40.730 2.224	4 32 03.24 17.09	.88	.48	.20920 1671	18 16 00
10	11 25 42.954 2.422	4 31 46.15 18.34	.88	.48	.22591 1673	18 12 07
11	11 25 45.376 + 2.615	+ 4 31 27.81 - 19.59	1.88	0.48	18.24264 +1672	18 08 13
12	11 25 47.991 2.808	4 31 08.22 20.80	.88	.48	.25936 1673	18 04 20
13	11 25 50.799 2.999	4 30 47.42 22.04	.88	.48	.27609 1672	18 00 27
14	11 25 53.798 3.190	4 30 25.38 23.25	.87	.48	.29281 1671	17 56 34
15	11 25 56.988 3.380	4 30 02.13 24.46	.87	.48	.30952 1669	17 52 42
16	11 26 00.368 + 3.571	+ 4 29 37.67 - 25.69	1.87	0.48	18.32621 +1667	17 48 49
17	11 26 03.939 3.763	4 29 11.98 26.91	.87	.48	.34288 1665	17 44 57
18	11 26 07.702 3.955	4 28 45.07 28.14	.87	.48	.35953 1662	17 41 05
19	11 26 11.657 4.147	4 28 16.93 29.36	.87	.48	.37615 1659	17 37 13
20	11 26 15.804 4.337	4 27 47.57 30.57	.86	.48	.39274 1655	17 33 22
21	11 26 20.141 + 4.526	+ 4 27 17.00 - 31.76	1.86	0.48	18.40929 +1651	17 29 30
22	11 26 24.667 4.712	4 26 45.24 32.93	.86	.48	.42580 1647	17 25 39
23	11 26 29.379 4.895	4 26 12.31 34.10	.86	.48	.44227 1641	17 21 48
24	11 26 34.274 5.075	4 25 38.21 35.23	.86	.48	.45868 1637	17 17 57
25	11 26 39.349 5.255	4 25 02.98 36.36	.86	.48	.47505 1631	17 14 06
26	11 26 44.604 + 5.434	+ 4 24 26.62 - 37.50	1.85	0.48	18.49136 +1624	17 10 16
27	11 26 50.038 5.611	4 23 49.12 38.63	.85	.48	.50760 1618	17 06 25
28	11 26 55.649 5.790	4 23 10.49 39.76	.85	.48	.52378 1611	17 02 35
29	11 27 01.439 5.967	4 22 30.73 40.88	.85	.47	.53989 1604	16 58 45
30	11 27 07.406 6.145	4 21 49.85 42.02	.85	.47	.55593 1596	16 54 55
July 1	11 27 13.551 + 6.322	+ 4 21 07.83 - 43.14	1.85	0.47	18.57189 +1588	16 51 06
2	11 27 19.873	+ 4 20 24.69	1.84	0.47	18.58777	16 47 16

URANUS, 1967 FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension			Apparent Declination			Semi- diam- eter	Hor. Par.	True Distance from the Earth			Ephem- eris Transit		
	^h	^m	^s	[°]	[']	["]	["]	["]				^h	^m	^s
July	1	11	27	13	55.1	+ 6.322	+ 4 21 07.83	-43.14	1.85	0.47	18.57189	+1588	16	51 06
	2	11	27	19	87.3	6.500	4 20 24.69	44.26	.84	.47	.58777	1579	16	47 16
	3	11	27	26	37.3	6.675	4 19 40.43	45.37	.84	.47	.60356	1570	16	43 27
	4	11	27	33	04.8	6.851	4 18 55.06	46.48	.84	.47	.61926	1560	16	39 38
	5	11	27	39	89.9	7.023	4 18 08.58	47.57	.84	.47	.63486	1551	16	35 49
	6	11	27	46	92.2	+ 7.194	+ 4 17 21.01	-48.66	1.84	0.47	18.65037	+1540	16	32 00
	7	11	27	54	11.6	7.363	4 16 32.35	49.71	.84	.47	.66577	1529	16	28 11
	8	11	28	01	47.9	7.528	4 15 42.64	50.76	.84	.47	.68106	1518	16	24 23
	9	11	28	09	00.7	7.689	4 14 51.88	51.77	.83	.47	.69624	1507	16	20 34
	10	11	28	16	69.6	7.850	4 14 00.11	52.79	.83	.47	.71131	1494	16	16 46
	11	11	28	24	54.6	+ 8.007	+ 4 13 07.32	-53.78	1.83	0.47	18.72625	+1482	16	12 58
	12	11	28	32	55.3	8.163	4 12 13.54	54.77	.83	.47	.74107	1469	16	09 10
	13	11	28	40	71.6	8.320	4 11 18.77	55.77	.83	.47	.75576	1456	16	05 23
	14	11	28	49	03.6	8.475	4 10 23.00	56.74	.83	.47	.77032	1442	16	01 35
	15	11	28	57	51.1	8.630	4 09 26.26	57.74	.82	.47	.78474	1429	15	57 48
	16	11	29	06	14.1	+ 8.785	+ 4 08 28.52	-58.70	1.82	0.47	18.79903	+1414	15	54 01
	17	11	29	14	92.6	8.937	4 07 29.82	59.66	.82	.47	.81317	1399	15	50 13
	18	11	29	23	86.3	9.087	4 06 30.16	60.59	.82	.47	.82716	1384	15	46 26
	19	11	29	32	95.0	9.232	4 05 29.57	61.51	.82	.47	.84100	1370	15	42 40
	20	11	29	42	18.2	9.376	4 04 28.06	62.41	.82	.47	.85470	1353	15	38 53
	21	11	29	51	55.8	+ 9.514	+ 4 03 25.65	-63.27	1.82	0.47	18.86823	+1338	15	35 07
	22	11	30	01	07.2	9.652	4 02 22.38	64.13	.82	.47	.88161	1322	15	31 20
	23	11	30	10	72.4	9.786	4 01 18.25	64.98	.81	.47	.89483	1305	15	27 34
	24	11	30	20	51.0	9.920	4 00 13.27	65.81	.81	.47	.90788	1289	15	23 48
	25	11	30	30	43.0	10.052	3 59 07.46	66.64	.81	.47	.92077	1271	15	20 02
	26	11	30	40	48.2	+ 10.184	+ 3 58 00.82	-67.47	1.81	0.46	18.93348	+1255	15	16 16
	27	11	30	50	66.6	10.314	3 56 53.35	68.30	.81	.46	.94603	1236	15	12 30
	28	11	31	00	98.0	10.444	3 55 45.05	69.11	.81	.46	.95839	1218	15	08 45
	29	11	31	11	42.4	10.573	3 54 35.94	69.91	.81	.46	.97057	1200	15	04 59
	30	11	31	21	99.7	10.700	3 53 26.03	70.72	.81	.46	.98257	1182	15	01 14
Aug.	31	11	31	32	69.7	+ 10.826	+ 3 52 15.31	-71.50	1.80	0.46	18.99439	+1162	14	57 29
	1	11	31	43	52.3	10.949	3 51 03.81	72.27	.80	.46	19.00601	1143	14	53 44
	2	11	31	54	47.2	11.069	3 49 51.54	73.03	.80	.46	.01744	1123	14	49 59
	3	11	32	05	54.1	11.187	3 48 38.51	73.76	.80	.46	.02867	1104	14	46 14
	4	11	32	16	72.8	11.300	3 47 24.75	74.46	.80	.46	.03971	1083	14	42 29
	5	11	32	28	02.8	+ 11.411	+ 3 46 10.29	-75.15	1.80	0.46	19.05054	+1062	14	38 45
	6	11	32	39	43.9	11.518	3 44 55.14	75.82	.80	.46	.06116	1042	14	35 00
	7	11	32	50	95.7	11.621	3 43 39.32	76.46	.80	.46	.07158	1021	14	31 16
	8	11	33	02	57.8	11.723	3 42 22.86	77.11	.80	.46	.08179	999	14	27 32
	9	11	33	14	30.1	11.824	3 41 05.75	77.73	.80	.46	.09178	977	14	23 47
	10	11	33	26	12.5	+ 11.924	+ 3 39 48.02	-78.36	1.79	0.46	19.10155	+ 956	14	20 03
	11	11	33	38	04.9	12.023	3 38 29.66	78.98	.79	.46	.11111	933	14	16 19
	12	11	33	50	07.2	12.121	3 37 10.68	79.59	.79	.46	.12044	911	14	12 35
	13	11	34	02	19.3	12.217	3 35 51.09	80.18	.79	.46	.12955	888	14	08 52
	14	11	34	14	41.0	12.309	3 34 30.91	80.75	.79	.46	.13843	866	14	05 08
	15	11	34	26	71.9	+ 12.398	+ 3 33 10.16	-81.29	1.79	0.46	19.14709	+ 843	14	01 24
	16	11	34	39	11.7		+ 3 31 48.87		1.79	0.46	19.15552		13	57 41

URANUS, 1967

FOR 0^h EPHEMERIS TIME

223

Date	Apparent Right Ascension				Apparent Declination				Semi- diam- eter	Hor. Par.	True Distance from the Earth		Ephem- eris Transit	
	h	m	s	s	°	'	"	"	"	"			h m s	
Aug. 16	11	34	39	117	+	3	31	48.87	-81.80	1.79	0.46	19.15552	+ 819	13 57 41
17	11	34	51	599		3	30	27.07	82.30	.79	.46	.16371	796	13 53 57
18	11	35	04	162		3	29	04.77	82.77	.79	.46	.17167	773	13 50 14
19	11	35	16	803		3	27	42.00	83.24	.79	.46	.17940	750	13 46 31
20	11	35	29	519		3	26	18.76	83.68	.79	.46	.18690	725	13 42 47
21	11	35	42	308	+	3	24	55.08	-84.12	1.79	0.46	19.19415	+ 701	13 39 04
22	11	35	55	169		3	23	30.96	84.55	.79	.46	.20116	678	13 35 21
23	11	36	08	100		3	22	06.41	84.97	.78	.46	.20794	653	13 31 38
24	11	36	21	100		3	20	41.44	85.38	.78	.46	.21447	628	13 27 55
25	11	36	34	168		3	19	16.06	85.79	.78	.46	.22075	604	13 24 12
26	11	36	47	301	+	3	17	50.27	-86.18	1.78	0.46	19.22679	+ 579	13 20 30
27	11	37	00	500		3	16	24.09	86.55	.78	.46	.23258	554	13 16 47
28	11	37	13	761		3	14	57.54	86.92	.78	.46	.23812	528	13 13 04
29	11	37	27	082		3	13	30.62	87.27	.78	.46	.24340	503	13 09 22
30	11	37	40	460		3	12	03.35	87.58	.78	.46	.24843	478	13 05 39
Sept. 31	11	37	53	891	+	3	10	35.77	-87.87	1.78	0.46	19.25321	+ 452	13 01 56
1	11	38	07	372		3	09	07.90	88.16	.78	.46	.25773	425	12 58 14
2	11	38	20	901		3	07	39.74	88.39	.78	.46	.26198	400	12 54 32
3	11	38	34	470		3	06	11.35	88.63	.78	.46	.26598	374	12 50 49
4	11	38	48	079		3	04	42.72	88.83	.78	.46	.26972	347	12 47 07
5	11	39	01	725	+	3	03	13.89	-89.03	1.78	0.46	19.27319	+ 321	12 43 25
6	11	39	15	404		3	01	44.86	89.23	.78	.46	.27640	294	12 39 42
7	11	39	29	117		3	00	15.63	89.41	.78	.46	.27934	268	12 36 00
8	11	39	42	863		2	58	46.22	89.59	.78	.46	.28202	241	12 32 18
9	11	39	56	640		2	57	16.63	89.74	.78	.46	.28443	214	12 28 36
10	11	40	10	445	+	2	55	46.89	-89.88	1.78	0.46	19.28657	+ 187	12 24 53
11	11	40	24	276		2	54	17.01	89.98	.78	.46	.28844	161	12 21 11
12	11	40	38	128		2	52	47.03	90.06	.78	.46	.29005	134	12 17 29
13	11	40	51	997		2	51	16.97	90.12	.78	.46	.29139	107	12 13 47
14	11	41	05	879		2	49	46.85	90.14	.78	.46	.29246	80	12 10 05
15	11	41	19	770	+	2	48	16.71	-90.16	1.78	0.46	19.29326	+ 53	12 06 23
16	11	41	33	669		2	46	46.55	90.16	.78	.46	.29379	+ 27	12 02 41
17	11	41	47	572		2	45	16.39	90.14	.78	.46	.29406	- 1	11 58 59
18	11	42	01	477		2	43	46.25	90.12	.78	.46	.29405	27	11 55 17
19	11	42	15	383		2	42	16.13	90.08	.78	.46	.29378	54	11 51 35
20	11	42	29	288	+	2	40	46.05	-90.05	1.78	0.46	19.29324	- 81	11 47 52
21	11	42	43	191		2	39	16.00	89.99	.78	.46	.29243	108	11 44 10
22	11	42	57	089		2	37	46.01	89.93	.78	.46	.29135	136	11 40 28
23	11	43	10	983		2	36	16.08	89.84	.78	.46	.28999	162	11 36 46
24	11	43	24	868		2	34	46.24	89.75	.78	.46	.28837	189	11 33 04
25	11	43	38	742	+	2	33	16.49	-89.63	1.78	0.46	19.28648	- 216	11 29 22
26	11	43	52	603		2	31	46.86	89.48	.78	.46	.28432	243	11 25 40
27	11	44	06	448		2	30	17.38	89.33	.78	.46	.28189	270	11 21 58
28	11	44	20	272		2	28	48.05	89.14	.78	.46	.27919	297	11 18 16
29	11	44	34	071		2	27	18.91	88.93	.78	.46	.27622	324	11 14 33
30	11	44	47	843	+	2	25	49.98	-88.69	1.78	0.46	19.27298	- 351	11 10 51
Oct. 1	11	45	01	582	+	2	24	21.29		1.78	0.46	19.26947		11 07 09

URANUS, 1967

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension			Apparent Declination			Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit		
	^h	^m	^s	[°]	[']	["]	["]	["]		^h	^m	^s
Oct.	1	11 45 01.582	+13.704	2 24 21.29	-88.43	1.78	0.46	19.26947	-377	11 07 09		
	2	11 45 15.286	13.667	2 22 52.86	88.16	.78	.46	.26570	405	11 03 27		
	3	11 45 28.953	13.628	2 21 24.70	87.88	.78	.46	.26165	431	10 59 44		
	4	11 45 42.581	13.587	2 19 56.82	87.59	.78	.46	.25734	459	10 56 02		
	5	11 45 56.168	13.548	2 18 29.23	87.30	.78	.46	.25275	484	10 52 19		
	6	11 46 09.716	+13.504	2 17 01.93	-86.99	1.78	0.46	19.24791	-511	10 48 37		
	7	11 46 23.220	13.458	2 15 34.94	86.66	.78	.46	.24280	538	10 44 54		
	8	11 46 36.678	13.407	2 14 08.28	86.29	.78	.46	.23742	563	10 41 12		
	9	11 46 50.085	13.353	2 12 41.99	85.91	.78	.46	.23179	590	10 37 29		
	10	11 47 03.438	13.293	2 11 16.08	85.49	.78	.46	.22589	615	10 33 47		
	11	11 47 16.731	+13.230	2 09 50.59	-85.04	1.78	0.46	19.21974	-641	10 30 04		
	12	11 47 29.961	13.165	2 08 25.55	84.58	.78	.46	.21333	667	10 26 21		
	13	11 47 43.126	13.096	2 07 00.97	84.10	.78	.46	.20666	692	10 22 38		
	14	11 47 56.222	13.025	2 05 36.87	83.62	.79	.46	.19974	717	10 18 55		
	15	11 48 09.247	12.953	2 04 13.25	83.12	.79	.46	.19257	742	10 15 12		
	16	11 48 22.200	+12.881	2 02 50.13	-82.60	1.79	0.46	19.18515	-767	10 11 29		
	17	11 48 35.081	12.805	2 01 27.53	82.09	.79	.46	.17748	792	10 07 46		
	18	11 48 47.886	12.728	2 00 05.44	81.56	.79	.46	.16956	816	10 04 03		
	19	11 49 00.614	12.649	1 58 43.88	81.01	.79	.46	.16140	840	10 00 20		
	20	11 49 13.263	12.568	1 57 22.87	80.47	.79	.46	.15300	865	9 56 36		
	21	11 49 25.831	+12.486	1 56 02.40	-79.89	1.79	0.46	19.14435	-888	9 52 53		
	22	11 49 38.317	12.399	1 54 42.51	79.30	.79	.46	.13547	912	9 49 10		
	23	11 49 50.716	12.310	1 53 23.21	78.69	.79	.46	.12635	936	9 45 26		
	24	11 50 03.026	12.218	1 52 04.52	78.06	.79	.46	.11699	960	9 41 42		
	25	11 50 15.244	12.121	1 50 46.46	77.40	.79	.46	.10739	982	9 37 58		
	26	11 50 27.365	+12.021	1 49 29.06	-76.73	1.79	0.46	19.09757	-1006	9 34 15		
	27	11 50 39.386	11.918	1 48 12.33	76.02	.80	.46	.08751	1028	9 30 30		
	28	11 50 51.304	11.811	1 46 56.31	75.29	.80	.46	.07723	1051	9 26 46		
	29	11 51 03.115	11.702	1 45 41.02	74.56	.80	.46	.06672	1073	9 23 02		
	30	11 51 14.817	11.589	1 44 26.46	73.80	.80	.46	.05599	1096	9 19 18		
Nov.	31	11 51 26.406	+11.478	1 43 12.66	-73.04	1.80	0.46	19.04503	-1117	9 15 33		
	1	11 51 37.884	11.366	1 41 59.62	72.29	.80	.46	.03386	1139	9 11 49		
	2	11 51 49.250	11.250	1 40 47.33	71.51	.80	.46	.02247	1160	9 08 04		
	3	11 52 00.500	11.135	1 39 35.82	70.73	.80	.46	19.01087	1181	9 04 20		
	4	11 52 11.635	11.014	1 38 25.09	69.91	.80	.46	18.99906	1202	9 00 35		
	5	11 52 22.649	+10.889	1 37 15.18	-69.07	1.81	0.46	18.98704	-1222	8 56 50		
	6	11 52 33.538	10.760	1 36 06.11	68.19	.81	.46	.97482	1241	8 53 05		
	7	11 52 44.298	10.628	1 34 57.92	67.30	.81	.46	.96241	1262	8 49 19		
	8	11 52 54.926	10.491	1 33 50.62	66.38	.81	.46	.94979	1280	8 45 34		
	9	11 53 05.417	10.353	1 32 44.24	65.46	.81	.46	.93699	1300	8 41 48		
	10	11 53 15.770	+10.212	1 31 38.78	-64.51	1.81	0.47	18.92399	-1317	8 38 03		
	11	11 53 25.982	10.072	1 30 34.27	63.57	.81	.47	.91082	1336	8 34 17		
	12	11 53 36.054	9.928	1 29 30.70	62.61	.81	.47	.89746	1354	8 30 31		
	13	11 53 45.982	9.785	1 28 28.09	61.65	.82	.47	.88392	1371	8 26 45		
	14	11 53 55.767	9.640	1 27 26.44	60.69	.82	.47	.87021	1389	8 22 59		
	15	11 54 05.407	+9.494	1 26 25.75	-59.70	1.82	0.47	18.85632	-1405	8 19 12		
	16	11 54 14.901		1 25 26.05		1.82	0.47	18.84227		8 15 26		

URANUS, 1967

FOR 0^h EPHEMERIS TIME

225

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Nov. 16	11 54 14.901	+ 1 25 26.05	1.82	0.47	18.84227	8 15 26
17	11 54 24.247	1 24 27.34	.82	.47	.82806	8 11 39
18	11 54 33.443	1 23 29.62	.82	.47	.81369	8 07 52
19	11 54 42.487	1 22 32.91	.82	.47	.79916	8 04 05
20	11 54 51.377	1 21 37.24	.82	.47	.78447	8 00 18
21	11 55 00.108	+ 1 20 42.62	1.83	0.47	18.76964	7 56 31
22	11 55 08.680	1 19 49.06	.83	.47	.75466	7 52 43
23	11 55 17.087	1 18 56.59	.83	.47	.73954	7 48 56
24	11 55 25.327	1 18 05.23	.83	.47	.72428	7 45 08
25	11 55 33.397	1 17 15.00	.83	.47	.70889	7 41 20
26	11 55 41.296	+ 1 16 25.90	1.83	0.47	18.69336	7 37 32
27	11 55 49.022	1 15 37.95	.84	.47	.67771	7 33 44
28	11 55 56.574	1 14 51.15	.84	.47	.66194	7 29 55
29	11 56 03.952	1 14 05.51	.84	.47	.64605	7 26 07
30	11 56 11.155	1 13 21.02	.84	.47	.63005	7 22 18
Dec. 1	11 56 18.183	+ 1 12 37.68	1.84	0.47	18.61394	7 18 29
2	11 56 25.033	1 11 55.53	.84	.47	.59773	7 14 40
3	11 56 31.702	1 11 14.58	.84	.47	.58141	7 10 50
4	11 56 38.186	1 10 34.85	.85	.47	.56501	7 07 01
5	11 56 44.482	1 09 56.36	.85	.47	.54852	7 03 11
6	11 56 50.586	+ 1 09 19.14	1.85	0.47	18.53194	6 59 21
7	11 56 56.498	1 08 43.19	.85	.48	.51529	6 55 31
8	11 57 02.216	1 08 08.51	.85	.48	.49856	6 51 41
9	11 57 07.740	1 07 35.12	.85	.48	.48176	6 47 50
10	11 57 13.069	1 07 03.00	.86	.48	.46491	6 44 00
11	11 57 18.204	+ 1 06 32.17	1.86	0.48	18.44799	6 40 09
12	11 57 23.144	1 06 02.61	.86	.48	.43102	6 36 18
13	11 57 27.890	1 05 34.33	.86	.48	.41400	6 32 27
14	11 57 32.440	1 05 07.33	.86	.48	.39694	6 28 35
15	11 57 36.794	1 04 41.62	.87	.48	.37984	6 24 43
16	11 57 40.952	+ 1 04 17.20	1.87	0.48	18.36271	6 20 52
17	11 57 44.911	1 03 54.07	.87	.48	.34555	6 17 00
18	11 57 48.669	1 03 32.26	.87	.48	.32836	6 13 07
19	11 57 52.226	1 03 11.77	.87	.48	.31116	6 09 15
20	11 57 55.579	1 02 52.61	.87	.48	.29393	6 05 22
21	11 57 58.725	+ 1 02 34.80	1.88	0.48	18.27670	6 01 30
22	11 58 01.665	1 02 18.33	.88	.48	.25947	5 57 36
23	11 58 04.396	1 02 03.23	.88	.48	.24223	5 53 43
24	11 58 06.919	1 01 49.47	.88	.48	.22500	5 49 50
25	11 58 09.234	1 01 37.08	.88	.48	.20778	5 45 56
26	11 58 11.342	+ 1 01 26.03	1.88	0.48	18.19058	5 42 02
27	11 58 13.244	1 01 16.33	.89	.48	.17340	5 38 08
28	11 58 14.941	1 01 07.96	.89	.48	.15624	5 34 14
29	11 58 16.432	1 01 00.93	.89	.49	.13912	5 30 19
30	11 58 17.717	1 00 55.24	.89	.49	.12203	5 26 25
31	11 58 18.792	+ 1 00 50.91	1.89	0.49	18.10499	5 22 30
32	11 58 19.657	+ 1 00 47.95	1.90	0.49	18.08800	5 18 35

NEPTUNE, 1967

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Jan. 0	15 26 15.137	-17 00 16.45	1.18	0.28	31.00537	8 48 58
1	15 26 22.074	17 00 39.50	.18	.28	30.99290	8 45 09
2	15 26 28.916	17 01 02.12	.18	.28	.98022	8 41 19
3	15 26 35.663	17 01 24.32	.18	.28	.96734	8 37 30
4	15 26 42.315	17 01 46.09	.18	.28	.95427	8 33 41
5	15 26 48.872	-17 02 07.44	1.18	0.28	30.94100	8 29 51
6	15 26 55.333	17 02 28.36	.18	.28	.92754	8 26 02
7	15 27 01.698	17 02 48.88	.18	.28	.91389	8 22 12
8	15 27 07.962	17 03 08.98	.18	.28	.90006	8 18 23
9	15 27 14.125	17 03 28.68	.18	.28	.88605	8 14 33
10	15 27 20.182	-17 03 47.96	1.18	0.29	30.87186	8 10 43
11	15 27 26.131	17 04 06.81	.18	.29	.85751	8 06 53
12	15 27 31.967	17 04 25.21	.19	.29	.84299	8 03 03
13	15 27 37.691	17 04 43.16	.19	.29	.82831	7 59 12
14	15 27 43.300	17 05 00.64	.19	.29	.81347	7 55 22
15	15 27 48.793	-17 05 17.65	1.19	0.29	30.79848	7 51 32
16	15 27 54.170	17 05 34.19	.19	.29	.78335	7 47 41
17	15 27 59.430	17 05 50.25	.19	.29	.76807	7 43 50
18	15 28 04.573	17 06 05.82	.19	.29	.75265	7 39 59
19	15 28 09.599	17 06 20.92	.19	.29	.73710	7 36 08
20	15 28 14.508	-17 06 35.55	1.19	0.29	30.72143	7 32 17
21	15 28 19.299	17 06 49.71	.19	.29	.70563	7 28 26
22	15 28 23.972	17 07 03.41	.19	.29	.68971	7 24 35
23	15 28 28.525	17 07 16.64	.19	.29	.67368	7 20 43
24	15 28 32.957	17 07 29.42	.19	.29	.65754	7 16 52
25	15 28 37.264	-17 07 41.74	1.19	0.29	30.64130	7 13 00
26	15 28 41.446	17 07 53.59	.19	.29	.62495	7 09 08
27	15 28 45.498	17 08 04.97	.19	.29	.60851	7 05 17
28	15 28 49.419	17 08 15.85	.20	.29	.59198	7 01 25
29	15 28 53.209	17 08 26.22	.20	.29	.57536	6 57 32
30	15 28 56.866	-17 08 36.07	1.20	0.29	30.55866	6 53 40
Feb. 31	15 29 00.395	17 08 45.41	.20	.29	.54189	6 49 48
1	15 29 03.794	17 08 54.24	.20	.29	.52504	6 45 55
2	15 29 07.065	17 09 02.57	.20	.29	.50813	6 42 02
3	15 29 10.207	17 09 10.41	.20	.29	.49115	6 38 10
4	15 29 13.218	-17 09 17.77	1.20	0.29	30.47411	6 34 17
5	15 29 16.098	17 09 24.65	.20	.29	.45702	6 30 23
6	15 29 18.843	17 09 31.05	.20	.29	.43989	6 26 30
7	15 29 21.452	17 09 36.95	.20	.29	.42271	6 22 37
8	15 29 23.923	17 09 42.36	.20	.29	.40550	6 18 43
9	15 29 26.254	-17 09 47.26	1.20	0.29	30.38826	6 14 50
10	15 29 28.445	17 09 51.65	.20	.29	.37099	6 10 56
11	15 29 30.495	17 09 55.52	.20	.29	.35370	6 07 02
12	15 29 32.406	17 09 58.87	.21	.29	.33640	6 03 08
13	15 29 34.177	17 10 01.69	.21	.29	.31909	5 59 14
14	15 29 35.811	-17 10 04.00	1.21	0.29	30.30178	5 55 20
15	15 29 37.306	17 10 05.81	1.21	0.29	30.28447	5 51 25

NEPTUNE, 1967
FOR 0^h EPHEMERIS TIME

227

Date	Apparent Right Ascension			Apparent Declination			Semi- diam- eter	Hor. Par.	True Distance from the Earth		Ephem- eris Transit
	h	m	s	°	'	"	"	"			h m s
Feb.	15	15 29 37.306	^s	-17 10 05.81	-	1.29	1.21	0.29	30.28447	-1730	5 51 25
	16	15 29 38.665	+1.359	17 10 07.10	-	0.79	.21	.29	.26717	1729	5 47 31
	17	15 29 39.887	1.222	17 10 07.89	-	0.31	.21	.29	.24988	1727	5 43 36
	18	15 29 40.975	1.088	17 10 08.20	+	0.17	.21	.29	.23261	1724	5 39 41
	19	15 29 41.925	0.950	17 10 08.03		0.64	.21	.29	.21537	1722	5 35 46
			0.816								
	20	15 29 42.741		-17 10 07.39	+	1.12	1.21	0.29	30.19815	-1718	5 31 51
	21	15 29 43.418	+0.677	17 10 06.27		1.59	.21	.29	.18097	1714	5 27 56
	22	15 29 43.958	0.540	17 10 04.68		2.06	.21	.29	.16383	1710	5 24 00
	23	15 29 44.358	0.400	17 10 02.62		2.56	.21	.29	.14673	1705	5 20 05
	24	15 29 44.617	0.259	17 10 00.06		3.05	.21	.29	.12968	1699	5 16 09
			+0.118								
	25	15 29 44.735		-17 09 57.01	+	3.56	1.21	0.29	30.11269	-1694	5 12 13
	26	15 29 44.713	-0.022	17 09 53.45		4.07	.21	.29	.09575	1687	5 08 17
	27	15 29 44.553	0.160	17 09 49.38		4.56	.22	.29	.07888	1680	5 04 21
	28	15 29 44.258	0.295	17 09 44.82		5.06	.22	.29	.06208	1674	5 00 25
Mar.	1	15 29 43.830	0.428	17 09 39.76		5.52	.22	.29	.04534	1665	4 56 28
			0.561								
	2	15 29 43.269		-17 09 34.24	+	5.98	1.22	0.29	30.02869	-1657	4 52 32
	3	15 29 42.576	-0.693	17 09 28.26		6.42	.22	.29	30.01212	1648	4 48 35
	4	15 29 41.751	0.825	17 09 21.84		6.88	.22	.29	29.99564	1639	4 44 39
	5	15 29 40.792	0.959	17 09 14.96		7.32	.22	.29	.97925	1629	4 40 42
	6	15 29 39.698	1.094	17 09 07.64		7.79	.22	.29	.96296	1619	4 36 45
			1.230								
	7	15 29 38.468		-17 08 59.85	+	8.23	1.22	0.29	29.94677	-1608	4 32 48
	8	15 29 37.102	-1.366	17 08 51.62		8.71	.22	.29	.93069	1597	4 28 50
	9	15 29 35.602	1.500	17 08 42.91		9.16	.22	.29	.91472	1584	4 24 53
	10	15 29 33.967	1.635	17 08 33.75		9.63	.22	.29	.89888	1572	4 20 55
	11	15 29 32.200	1.767	17 08 24.12		10.09	.22	.29	.88316	1559	4 16 58
			1.899								
	12	15 29 30.301		-17 08 14.03	+	10.54	1.22	0.29	29.86757	-1546	4 13 00
	13	15 29 28.273	-2.028	17 08 03.49		10.99	.22	.29	.85211	1532	4 09 02
	14	15 29 26.119	2.154	17 07 52.50		11.43	.23	.29	.83679	1517	4 05 04
	15	15 29 23.840	2.279	17 07 41.07		11.84	.23	.30	.82162	1502	4 01 06
	16	15 29 21.438	2.402	17 07 29.23		12.25	.23	.30	.80660	1487	3 57 07
			2.523								
	17	15 29 18.915		-17 07 16.98	+	12.66	1.23	0.30	29.79173	-1472	3 53 09
	18	15 29 16.272	-2.643	17 07 04.32		13.04	.23	.30	.77701	1455	3 49 10
	19	15 29 13.509	2.763	17 06 51.28		13.42	.23	.30	.76246	1438	3 45 12
	20	15 29 10.628	2.881	17 06 37.86		13.80	.23	.30	.74808	1421	3 41 13
	21	15 29 07.629	2.999	17 06 24.06		14.17	.23	.30	.73387	1403	3 37 14
			3.118								
	22	15 29 04.511		-17 06 09.89	+	14.56	1.23	0.30	29.71984	-1386	3 33 15
	23	15 29 01.276	-3.235	17 05 55.33		14.93	.23	.30	.70598	1367	3 29 16
	24	15 28 57.922	3.354	17 05 40.40		15.34	.23	.30	.69231	1349	3 25 16
	25	15 28 54.452	3.470	17 05 25.06		15.72	.23	.30	.67882	1330	3 21 17
	26	15 28 50.868	3.584	17 05 09.34		16.11	.23	.30	.66552	1310	3 17 18
			3.692								
	27	15 28 47.176		-17 04 53.23	+	16.48	1.23	0.30	29.65242	-1291	3 13 18
	28	15 28 43.377	-3.799	17 04 36.75		16.83	.23	.30	.63951	1270	3 09 18
	29	15 28 39.475	3.902	17 04 19.92		17.16	.23	.30	.62681	1250	3 05 18
	30	15 28 35.472	4.003	17 04 02.76		17.47	.23	.30	.61431	1229	3 01 19
	31	15 28 31.368	4.104	17 03 45.29		17.79	.24	.30	.60202	1208	2 57 19
			4.204								
Apr.	1	15 28 27.164		-17 03 27.50	+	18.09	1.24	0.30	29.58994	-1187	2 53 18
	2	15 28 22.858	-4.306	17 03 09.41			1.24	0.30	29.57807		2 49 18

NEPTUNE, 1967

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Apr. 1	15 28 27.164 -4.306	-17 03 27.50 +18.09	1.24	0.30	29.58994 -1187	2 53 18
2	15 28 22.858 4.407	17 03 09.41 18.40	.24	.30	.57807 1164	2 49 18
3	15 28 18.451 4.508	17 02 51.01 18.72	.24	.30	.56643 1142	2 45 18
4	15 28 13.943 4.605	17 02 32.29 19.03	.24	.30	.55501 1119	2 41 18
5	15 28 09.338 4.702	17 02 13.26 19.34	.24	.30	.54382 1096	2 37 17
6	15 28 04.636 -4.797	-17 01 53.92 +19.64	1.24	0.30	29.53286 -1072	2 33 17
7	15 27 59.839 4.887	17 01 34.28 19.95	.24	.30	.52214 1049	2 29 16
8	15 27 54.952 4.976	17 01 14.33 20.23	.24	.30	.51165 1025	2 25 15
9	15 27 49.976 5.061	17 00 54.10 20.52	.24	.30	.50140 1000	2 21 14
10	15 27 44.915 5.142	17 00 33.58 20.78	.24	.30	.49140 975	2 17 13
11	15 27 39.773 -5.222	-17 00 12.80 +21.04	1.24	0.30	29.48165 -950	2 13 12
12	15 27 34.551 5.298	16 59 51.76 21.27	.24	.30	.47215 925	2 09 11
13	15 27 29.253 5.372	16 59 30.49 21.49	.24	.30	.46290 899	2 05 10
14	15 27 23.881 5.444	16 59 09.00 21.70	.24	.30	.45391 873	2 01 09
15	15 27 18.437 5.516	16 58 47.30 21.89	.24	.30	.44518 847	1 57 07
16	15 27 12.921 -5.584	-16 58 25.41 +22.09	1.24	0.30	29.43671 -820	1 53 06
17	15 27 07.337 5.653	16 58 03.32 22.27	.24	.30	.42851 794	1 49 04
18	15 27 01.684 5.720	16 57 41.05 22.45	.24	.30	.42057 767	1 45 03
19	15 26 55.964 5.785	16 57 18.60 22.64	.24	.30	.41290 740	1 41 01
20	15 26 50.179 5.850	16 56 55.96 22.82	.24	.30	.40550 713	1 37 00
21	15 26 44.329 -5.911	-16 56 33.14 +23.01	1.24	0.30	29.39837 -686	1 32 58
22	15 26 38.418 5.967	16 56 10.13 23.19	.24	.30	.39151 658	1 28 56
23	15 26 32.451 6.019	16 55 46.94 23.36	.24	.30	.38493 630	1 24 54
24	15 26 26.432 6.068	16 55 23.58 23.51	.24	.30	.37863 603	1 20 52
25	15 26 20.364 6.112	16 55 00.07 23.63	.24	.30	.37260 575	1 16 50
26	15 26 14.252 -6.155	-16 54 36.44 +23.73	1.24	0.30	29.36685 -547	1 12 48
27	15 26 08.097 6.198	16 54 12.71 23.82	.25	.30	.36138 518	1 08 46
28	15 26 01.899 6.241	16 53 48.89 23.91	.25	.30	.35620 490	1 04 44
29	15 25 55.658 6.281	16 53 24.98 23.99	.25	.30	.35130 462	1 00 42
30	15 25 49.377 6.322	16 53 00.99 24.09	.25	.30	.34668 432	0 56 40
May 1	15 25 43.055 -6.362	-16 52 36.90 +24.17	1.25	0.30	29.34236 -404	0 52 38
2	15 25 36.693 6.397	16 52 12.73 24.24	.25	.30	.33832 375	0 48 36
3	15 25 30.296 6.430	16 51 48.49 24.34	.25	.30	.33457 346	0 44 33
4	15 25 23.866 6.461	16 51 24.15 24.40	.25	.30	.33111 316	0 40 31
5	15 25 17.405 6.486	16 50 59.75 24.45	.25	.30	.32795 287	0 36 29
6	15 25 10.919 -6.509	-16 50 35.30 +24.51	1.25	0.30	29.32508 -258	0 32 26
7	15 25 04.410 6.528	16 50 10.79 24.53	.25	.30	.32250 228	0 28 24
8	15 24 57.882 6.544	16 49 46.26 24.56	.25	.30	.32022 199	0 24 22
9	15 24 51.338 6.556	16 49 21.70 24.55	.25	.30	.31823 168	0 20 19
10	15 24 44.782 6.565	16 48 57.15 24.54	.25	.30	.31655 139	0 16 17
11	15 24 38.217 -6.573	-16 48 32.61 +24.50	1.25	0.30	29.31516 -110	0 12 14
12	15 24 31.644 6.578	16 48 08.11 24.46	.25	.30	.31406 80	0 08 12
13	15 24 25.066 6.582	16 47 43.65 24.41	.25	.30	.31326 50	0 04 09
14	15 24 18.484 6.585	16 47 19.24 24.34	.25	.30	.31276 20	{ 0 00 07 }
15	15 24 11.899 6.585	16 46 54.90 24.28	.25	.30	.31256 + 10	{ 23 56 04 }
16	15 24 05.314 -6.586	-16 46 30.62 +24.22	1.25	0.30	29.31266 + 39	23 48 00
17	15 23 58.728	-16 46 06.40	1.25	0.30	29.31305	23 43 57

NEPTUNE, 1967

FOR 0^h EPHEMERIS TIME

229

Date	Apparent Right Ascension		Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s		[°] ['] ["]	["]	["]		^h ^m ^s
May	17	15 23 58.728	-16 46 06.40	1.25	0.30	29.31305 + 68	23 43 57
	18	15 23 52.146	16 45 42.25	.25	.30	.31373 + 98	23 39 55
	19	15 23 45.569	16 45 18.15	.25	.30	.31471 + 127	23 35 52
	20	15 23 39.002	16 44 54.12	.25	.30	.31598 + 157	23 31 50
	21	15 23 32.449	16 44 30.18	.25	.30	.31755 + 185	23 27 47
	22	15 23 25.913	-16 44 06.34	1.25	0.30	29.31940 + 215	23 23 45
	23	15 23 19.400	16 43 42.61	.25	.30	.32155 + 244	23 19 43
	24	15 23 12.912	16 43 19.03	.25	.30	.32399 + 272	23 15 40
	25	15 23 06.449	16 42 55.60	.25	.30	.32671 + 302	23 11 38
	26	15 23 00.012	16 42 32.34	.25	.30	.32973 + 330	23 07 36
	27	15 22 53.601	-16 42 09.25	1.25	0.30	29.33303 + 359	23 03 33
	28	15 22 47.217	16 41 46.32	.25	.30	.33662 + 387	22 59 31
	29	15 22 40.862	16 41 23.56	.25	.30	.34049 + 416	22 55 29
	30	15 22 34.537	16 41 00.96	.25	.30	.34465 + 444	22 51 27
	31	15 22 28.245	16 40 38.53	.25	.30	.34909 + 472	22 47 25
June	1	15 22 21.989	-16 40 16.28	1.25	0.30	29.35381 + 500	22 43 23
	2	15 22 15.774	16 39 54.22	.25	.30	.35881 + 529	22 39 20
	3	15 22 09.602	16 39 32.35	.25	.30	.36410 + 556	22 35 18
	4	15 22 03.476	16 39 10.69	.24	.30	.36966 + 583	22 31 17
	5	15 21 57.401	16 38 49.26	.24	.30	.37549 + 612	22 27 15
	6	15 21 51.378	-16 38 28.07	1.24	0.30	29.38161 + 638	22 23 13
	7	15 21 45.412	16 38 07.14	.24	.30	.38799 + 665	22 19 11
	8	15 21 39.503	16 37 46.48	.24	.30	.39464 + 693	22 15 09
	9	15 21 33.653	16 37 26.10	.24	.30	.40157 + 718	22 11 08
	10	15 21 27.864	16 37 06.02	.24	.30	.40875 + 746	22 07 06
	11	15 21 22.137	-16 36 46.24	1.24	0.30	29.41621 + 771	22 03 04
	12	15 21 16.473	16 36 26.75	.24	.30	.42392 + 797	21 59 03
	13	15 21 10.872	16 36 07.56	.24	.30	.43189 + 823	21 55 02
	14	15 21 05.336	16 35 48.67	.24	.30	.44012 + 847	21 51 00
	15	15 20 59.868	16 35 30.07	.24	.30	.44859 + 873	21 46 59
	16	15 20 54.471	-16 35 11.76	1.24	0.30	29.45732 + 897	21 42 58
	17	15 20 49.148	16 34 53.77	.24	.30	.46629 + 922	21 38 57
	18	15 20 43.903	16 34 36.09	.24	.30	.47551 + 945	21 34 55
	19	15 20 38.740	16 34 18.75	.24	.30	.48496 + 969	21 30 54
	20	15 20 33.660	16 34 01.77	.24	.30	.49465 + 993	21 26 54
	21	15 20 28.666	-16 33 45.16	1.24	0.30	29.50458 + 1016	21 22 53
	22	15 20 23.757	16 33 28.93	.24	.30	.51474 + 1038	21 18 52
	23	15 20 18.934	16 33 13.08	.24	.30	.52512 + 1061	21 14 51
	24	15 20 14.194	16 32 57.61	.24	.30	.53573 + 1083	21 10 51
	25	15 20 09.539	16 32 42.52	.24	.30	.54656 + 1105	21 06 50
	26	15 20 04.971	-16 32 27.80	1.24	0.30	29.55761 + 1127	21 02 50
	27	15 20 00.491	16 32 13.46	.24	.30	.56888 + 1148	20 58 50
	28	15 19 56.100	16 31 59.48	.24	.30	.58036 + 1169	20 54 50
	29	15 19 51.804	16 31 45.89	.24	.30	.59205 + 1189	20 50 49
	30	15 19 47.603	16 31 32.69	.23	.30	.60394 + 1210	20 46 49
July	1	15 19 43.500	-16 31 19.88	1.23	0.30	29.61604 + 1230	20 42 50
	2	15 19 39.499	-16 31 07.49	1.23	0.30	29.62834 + 1230	20 38 50

NEPTUNE, 1967

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension				Apparent Declination				Semi- diam- eter	Hor. Par.	True Distance from the Earth				Ephem- eris Transit		
	h	m	s	"	°	'	"	"	"	"					h	m	s
July	1	15	19	43.500	4.001	-16	31	19.88	+12.39	1.23	0.30	29.61604	+1230	20	42	50	
	2	15	19	39.409	3.898	16	31	07.49	11.98	.23	.30	.62834	1250	20	38	50	
	3	15	19	35.601	3.792	16	30	55.51	11.53	.23	.30	.64084	1269	20	34	50	
	4	15	19	31.809	3.686	16	30	43.98	11.09	.23	.30	.65353	1288	20	30	50	
	5	15	19	28.123	3.578	16	30	32.89	10.63	.23	.30	.66641	1306	20	26	51	
	6	15	19	24.545	-3.469	-16	30	22.26	+10.17	1.23	0.30	29.67947	+1324	20	22	52	
	7	15	19	21.076	3.360	16	30	12.09	9.71	.23	.30	.69271	1342	20	18	52	
	8	15	19	17.716	3.252	16	30	02.38	9.23	.23	.30	.70613	1360	20	14	53	
	9	15	19	14.464	3.144	16	29	53.15	8.79	.23	.30	.71973	1376	20	10	54	
	10	15	19	11.320	3.034	16	29	44.36	8.32	.23	.30	.73349	1393	20	06	55	
	11	15	19	08.286	-2.924	-16	29	36.04	+7.88	1.23	0.30	29.74742	+1408	20	02	56	
	12	15	19	05.362	2.812	16	29	28.16	7.43	.23	.30	.76150	1424	19	58	58	
	13	15	19	02.550	2.695	16	29	20.73	6.99	.23	.30	.77574	1439	19	54	59	
	14	15	18	59.855	2.578	16	29	13.74	6.53	.23	.30	.79013	1454	19	51	00	
	15	15	18	57.277	2.458	16	29	07.21	6.05	.23	.30	.80467	1468	19	47	02	
	16	15	18	54.819	-2.335	-16	29	01.16	+5.57	1.23	0.30	29.81935	+1482	19	43	04	
	17	15	18	52.484	2.212	16	28	55.59	5.06	.23	.29	.83417	1495	19	39	06	
	18	15	18	50.272	2.090	16	28	50.53	4.56	.22	.29	.84912	1507	19	35	08	
	19	15	18	48.182	1.968	16	28	45.97	4.06	.22	.29	.86419	1520	19	31	10	
	20	15	18	46.214	1.848	16	28	41.91	3.56	.22	.29	.87939	1532	19	27	12	
	21	15	18	44.366	-1.729	-16	28	38.35	+3.06	1.22	0.29	29.89471	+1544	19	23	14	
	22	15	18	42.637	1.610	16	28	35.29	2.58	.22	.29	.91015	1555	19	19	17	
	23	15	18	41.027	1.489	16	28	32.71	2.09	.22	.29	.92570	1566	19	15	19	
	24	15	18	39.538	1.369	16	28	30.62	1.63	.22	.29	.94136	1576	19	11	22	
	25	15	18	38.169	1.245	16	28	28.99	1.14	.22	.29	.95712	1586	19	07	25	
	26	15	18	36.924	-1.122	-16	28	27.85	+0.66	1.22	0.29	29.97298	+1596	19	03	28	
	27	15	18	35.802	0.995	16	28	27.19	+0.18	.22	.29	29.98894	1604	18	59	31	
	28	15	18	34.807	0.867	16	28	27.01	-0.31	.22	.29	30.00498	1614	18	55	34	
	29	15	18	33.940	0.738	16	28	27.32	0.82	.22	.29	.02112	1621	18	51	38	
	30	15	18	33.202	0.607	16	28	28.14	1.32	.22	.29	.03733	1630	18	47	41	
Aug.	31	15	18	32.595	-0.477	-16	28	29.46	+1.84	1.22	0.29	30.05363	+1636	18	43	45	
	1	15	18	32.118	0.344	16	28	31.30	2.37	.22	.29	.06999	1643	18	39	48	
	2	15	18	31.774	0.215	16	28	33.67	2.89	.22	.29	.08642	1650	18	35	52	
	3	15	18	31.559	-0.083	16	28	36.56	3.42	.21	.29	.10292	1656	18	31	56	
	4	15	18	31.476	+0.045	16	28	39.98	3.94	.21	.29	.11948	1661	18	28	00	
	5	15	18	31.521	+0.174	-16	28	43.92	-4.45	1.21	0.29	30.13609	+1666	18	24	04	
	6	15	18	31.695	0.301	16	28	48.37	4.96	.21	.29	.15275	1670	18	20	09	
	7	15	18	31.996	0.429	16	28	53.33	5.45	.21	.29	.16945	1674	18	16	13	
	8	15	18	32.425	0.557	16	28	58.78	5.93	.21	.29	.18619	1677	18	12	18	
	9	15	18	32.982	0.687	16	29	04.71	6.41	.21	.29	.20296	1681	18	08	23	
	10	15	18	33.669	+0.818	-16	29	11.12	-6.90	1.21	0.29	30.21977	+1682	18	04	27	
	11	15	18	34.487	0.953	16	29	18.02	7.40	.21	.29	.23659	1684	18	00	32	
	12	15	18	35.440	1.087	16	29	25.42	7.89	.21	.29	.25343	1686	17	56	38	
	13	15	18	36.527	1.221	16	29	33.31	8.42	.21	.29	.27029	1686	17	52	43	
	14	15	18	37.748	1.355	16	29	41.73	8.93	.21	.29	.28715	1687	17	48	48	
	15	15	18	39.103	+1.485	-16	29	50.66	-9.44	1.21	0.29	30.30402	+1687	17	44	54	
16	15	18	40.588		-16	30	00.10		1.21	0.29	30.32089		17	41	00		

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Aug. 16	15 18 40.588 +1.615	-16 30 00.10 - 9.95	1.21	0.29	30.32089 +1686	17 41 00
17	15 18 42.203 1.742	16 30 10.05 10.45	.21	.29	.33775 1685	17 37 05
18	15 18 43.945 1.868	16 30 20.50 10.93	.20	.29	.35460 1684	17 33 11
19	15 18 45.813 1.993	16 30 31.43 11.41	.20	.29	.37144 1682	17 29 17
20	15 18 47.806 2.119	16 30 42.84 11.87	.20	.29	.38826 1680	17 25 23
21	15 18 49.925 +2.245	-16 30 54.71 -12.33	1.20	0.29	30.40506 +1677	17 21 30
22	15 18 52.170 2.372	16 31 07.04 12.79	.20	.29	.42183 1673	17 17 36
23	15 18 54.542 2.500	16 31 19.83 13.26	.20	.29	.43856 1671	17 13 43
24	15 18 57.042 2.627	16 31 33.09 13.71	.20	.29	.45527 1666	17 09 49
25	15 18 59.669 2.757	16 31 46.80 14.18	.20	.29	.47193 1661	17 05 56
26	15 19 02.426 +2.886	-16 32 00.98 -14.65	1.20	0.29	30.48854 +1657	17 02 03
27	15 19 05.312 3.015	16 32 15.63 15.12	.20	.29	.50511 1651	16 58 10
28	15 19 08.327 3.142	16 32 30.75 15.60	.20	.29	.52162 1645	16 54 17
29	15 19 11.469 3.271	16 32 46.35 16.08	.20	.29	.53807 1639	16 50 25
30	15 19 14.740 3.396	16 33 02.43 16.55	.20	.29	.55446 1632	16 46 32
Sept. 31	15 19 18.136 +3.520	-16 33 18.98 -17.03	1.20	0.29	30.57078 +1625	16 42 40
1	15 19 21.656 3.643	16 33 36.01 17.48	.20	.29	.58703 1617	16 38 47
2	15 19 25.299 3.763	16 33 53.49 17.92	.19	.29	.60320 1609	16 34 55
3	15 19 29.062 3.881	16 34 11.41 18.36	.19	.29	.61929 1600	16 31 03
4	15 19 32.943 4.001	16 34 29.77 18.76	.19	.29	.63529 1591	16 27 11
5	15 19 36.944 +4.119	-16 34 48.53 -19.18	1.19	0.29	30.65120 +1581	16 23 19
6	15 19 41.063 4.240	16 35 07.71 19.58	.19	.29	.66701 1571	16 19 27
7	15 19 45.303 4.361	16 35 27.29 19.98	.19	.29	.68272 1560	16 15 36
8	15 19 49.664 4.483	16 35 47.27 20.41	.19	.29	.69832 1549	16 11 44
9	15 19 54.147 4.605	16 36 07.68 20.83	.19	.29	.71381 1537	16 07 53
10	15 19 58.752 +4.722	-16 36 28.51 -21.25	1.19	0.29	30.72918 +1525	16 04 02
11	15 20 03.474 4.839	16 36 49.76 21.67	.19	.29	.74443 1513	16 00 11
12	15 20 08.313 4.953	16 37 11.43 22.08	.19	.29	.75956 1500	15 56 20
13	15 20 13.266 5.063	16 37 33.51 22.48	.19	.29	.77456 1487	15 52 29
14	15 20 18.329 5.171	16 37 55.99 22.86	.19	.29	.78943 1474	15 48 38
15	15 20 23.500 +5.278	-16 38 18.85 -23.23	1.19	0.29	30.80417 +1459	15 44 47
16	15 20 28.778 5.385	16 38 42.08 23.58	.19	.29	.81876 1445	15 40 57
17	15 20 34.163 5.490	16 39 05.66 23.93	.19	.29	.83321 1430	15 37 06
18	15 20 39.653 5.595	16 39 29.59 24.27	.19	.29	.84751 1415	15 33 16
19	15 20 45.248 5.701	16 39 53.86 24.61	.18	.29	.86166 1400	15 29 25
20	15 20 50.949 +5.806	-16 40 18.47 -24.94	1.18	0.29	30.87566 +1383	15 25 35
21	15 20 56.755 5.912	16 40 43.41 25.28	.18	.28	.88949 1368	15 21 45
22	15 21 02.667 6.016	16 41 08.69 25.62	.18	.28	.90317 1351	15 17 55
23	15 21 08.683 6.120	16 41 34.31 25.96	.18	.28	.91668 1334	15 14 05
24	15 21 14.803 6.223	16 42 00.27 26.30	.18	.28	.93002 1317	15 10 16
25	15 21 21.026 +6.323	-16 42 26.57 -26.64	1.18	0.28	30.94319 +1298	15 06 26
26	15 21 27.349 6.423	16 42 53.21 26.96	.18	.28	.95617 1281	15 02 36
27	15 21 33.772 6.519	16 43 20.17 27.30	.18	.28	.96898 1262	14 58 47
28	15 21 40.291 6.613	16 43 47.47 27.61	.18	.28	.98160 1244	14 54 58
29	15 21 46.904 6.705	16 44 15.08 27.90	.18	.28	30.99404 1224	14 51 08
30	15 21 53.609 +6.794	-16 44 42.98 -28.19	1.18	0.28	31.00628 +1205	14 47 19
Oct. 1	15 22 00.403	-16 45 11.17	1.18	0.28	31.01833	14 43 30

NEPTUNE, 1967

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Oct. 1	15 22 00.403 +6.882	-16 45 11.17 -28.46	1.18	0.28	31.01833 +1184	14 43 30
2	15 22 07.285 6.969	16 45 39.63 28.71	.18	.28	.03017 1164	14 39 41
3	15 22 14.254 7.056	16 46 08.34 28.95	.18	.28	.04181 1144	14 35 52
4	15 22 21.310 7.144	16 46 37.29 29.19	.18	.28	.05325 1122	14 32 03
5	15 22 28.454 7.233	16 47 06.48 29.44	.18	.28	.06447 1100	14 28 15
6	15 22 35.687 +7.319	-16 47 35.92 -29.69	1.18	0.28	31.07547 +1079	14 24 26
7	15 22 43.006 7.405	16 48 05.61 29.95	.18	.28	.08626 1057	14 20 37
8	15 22 50.411 7.486	16 48 35.56 30.21	.18	.28	.09683 1034	14 16 49
9	15 22 57.897 7.564	16 49 05.77 30.44	.18	.28	.10717 1012	14 13 00
10	15 23 05.461 7.638	16 49 36.21 30.67	.17	.28	.11729 988	14 09 12
11	15 23 13.099 +7.709	-16 50 06.88 -30.88	1.17	0.28	31.12717 +966	14 05 24
12	15 23 20.808 7.778	16 50 37.76 31.07	.17	.28	.13683 941	14 01 36
13	15 23 28.586 7.845	16 51 08.83 31.24	.17	.28	.14624 919	13 57 47
14	15 23 36.431 7.912	16 51 40.07 31.41	.17	.28	.15543 894	13 53 59
15	15 23 44.343 7.976	16 52 11.48 31.57	.17	.28	.16437 870	13 50 11
16	15 23 52.319 +8.042	-16 52 43.05 -31.72	1.17	0.28	31.17307 +845	13 46 23
17	15 24 00.361 8.106	16 53 14.77 31.87	.17	.28	.18152 821	13 42 36
18	15 24 08.467 8.170	16 53 46.64 32.01	.17	.28	.18973 796	13 38 48
19	15 24 16.637 8.232	16 54 18.65 32.16	.17	.28	.19769 771	13 35 00
20	15 24 24.869 8.293	16 54 50.81 32.31	.17	.28	.20540 746	13 31 12
21	15 24 33.162 +8.353	-16 55 23.12 -32.45	1.17	0.28	31.21286 +720	13 27 25
22	15 24 41.515 8.411	16 55 55.57 32.60	.17	.28	.22006 694	13 23 37
23	15 24 49.926 8.465	16 56 28.17 32.72	.17	.28	.22700 669	13 19 50
24	15 24 58.391 8.517	16 57 00.89 32.87	.17	.28	.23369 642	13 16 02
25	15 25 06.908 8.567	16 57 33.76 32.97	.17	.28	.24011 615	13 12 15
26	15 25 15.475 +8.613	-16 58 06.73 -33.08	1.17	0.28	31.24626 +590	13 08 27
27	15 25 24.088 8.656	16 58 39.81 33.17	.17	.28	.25216 562	13 04 40
28	15 25 32.744 8.698	16 59 12.98 33.24	.17	.28	.25778 535	13 00 53
29	15 25 41.442 8.737	16 59 46.22 33.29	.17	.28	.26313 508	12 57 06
30	15 25 50.179 8.777	17 00 19.51 33.33	.17	.28	.26821 480	12 53 18
31	15 25 58.956 +8.815	-17 00 52.84 -33.36	1.17	0.28	31.27301 +453	12 49 31
Nov. 1	15 26 07.771 8.855	17 01 26.20 33.40	.17	.28	.27754 425	12 45 44
2	15 26 16.626 8.893	17 01 59.60 33.44	.17	.28	.28179 397	12 41 57
3	15 26 25.519 8.929	17 02 33.04 33.49	.17	.28	.28576 369	12 38 10
4	15 26 34.448 8.963	17 03 06.53 33.54	.17	.28	.28945 341	12 34 23
5	15 26 43.411 +8.991	-17 03 40.07 -33.57	1.17	0.28	31.29286 +312	12 30 36
6	15 26 52.402 9.015	17 04 13.64 33.60	.17	.28	.29598 284	12 26 49
7	15 27 01.417 9.035	17 04 47.24 33.60	.17	.28	.29882 255	12 23 02
8	15 27 10.452 9.053	17 05 20.84 33.59	.17	.28	.30137 227	12 19 15
9	15 27 19.505 9.069	17 05 54.43 33.54	.17	.28	.30364 198	12 15 28
10	15 27 28.574 +9.082	-17 06 27.97 -33.51	1.17	0.28	31.30562 +169	12 11 41
11	15 27 37.656 9.095	17 07 01.48 33.46	.17	.28	.30731 141	12 07 54
12	15 27 46.751 9.107	17 07 34.94 33.39	.17	.28	.30872 112	12 04 08
13	15 27 55.858 9.118	17 08 08.33 33.33	.17	.28	.30984 84	12 00 21
14	15 28 04.976 9.128	17 08 41.66 33.27	.17	.28	.31068 54	11 56 34
15	15 28 14.104 +9.137	-17 09 14.93 -33.19	1.17	0.28	31.31122 +26	11 52 47
16	15 28 23.241	-17 09 48.12	1.17	0.28	31.31148	11 49 00

NEPTUNE, 1967
FOR 0^h EPHEMERIS TIME

233

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Nov. 16	15 28 23.241 ^s	-17 09 48.12 ["]	1.17	0.28	31.31148	11 49 00
17	15 28 32.385 ^{+9.144}	17 10 21.26 ^{-33.14}	.17	.28	.31146 ⁻	11 45 13 ²
18	15 28 41.534 ^{9.149}	17 10 54.32 ^{33.06}	.17	.28	.31114 ³²	11 41 27 ⁶¹
19	15 28 50.687 ^{9.153}	17 11 27.31 ^{32.99}	.17	.28	.31053 ⁸⁹	11 37 40 ¹¹⁸
20	15 28 59.840 ^{9.150}	17 12 00.23 ^{32.92}	.17	.28	.30964 ¹¹⁸	11 33 53
21	15 29 08.990	-17 12 33.07 ^{-32.74}	1.17	0.28	31.30846 ⁻	11 30 06 ¹⁴⁷
22	15 29 18.135 ^{+9.145}	17 13 05.81 ^{32.64}	.17	.28	.30699 ¹⁷⁶	11 26 19 ²⁰⁴
23	15 29 27.270 ^{9.135}	17 13 38.45 ^{32.51}	.17	.28	.30523 ²³⁴	11 22 33 ²⁶²
24	15 29 36.394 ^{9.124}	17 14 10.96 ^{32.38}	.17	.28	.30319 ²⁶²	11 18 46
25	15 29 45.503 ^{9.109}	17 14 43.34 ^{32.22}	.17	.28	.30085 ²⁹¹	11 14 59 ³²⁰
26	15 29 54.596 ^{+9.075}	-17 15 15.56 ^{-32.07}	1.17	0.28	31.29823 ⁻	11 11 12 ³⁴⁸
27	15 30 03.671 ^{9.057}	17 15 47.63 ^{31.88}	.17	.28	.29532 ³⁷⁸	11 07 25 ⁴⁰⁶
28	15 30 12.728 ^{9.039}	17 16 19.51 ^{31.72}	.17	.28	.29212 ⁴³⁴	11 03 38 ⁴⁶³
29	15 30 21.767 ^{9.020}	17 16 51.23 ^{31.53}	.17	.28	.28864 ⁴⁹¹	10 59 51 ⁵¹⁹
30	15 30 30.787 ^{9.001}	17 17 22.76 ^{31.38}	.17	.28	.28486 ⁵⁴⁷	10 56 04 ⁵⁷⁵
Dec. 1	15 30 39.788 ^{+8.977}	-17 17 54.14 ^{-31.21}	1.17	0.28	31.28080 ⁻	10 52 17 ⁶⁰²
2	15 30 48.765 ^{8.950}	17 18 25.35 ^{31.05}	.17	.28	.27646 ⁶³⁰	10 48 30 ⁶⁵⁶
3	15 30 57.715 ^{8.919}	17 18 56.40 ^{30.88}	.17	.28	.27183 ⁶⁸⁴	10 44 43 ⁷¹¹
4	15 31 06.634 ^{8.882}	17 19 27.28 ^{30.67}	.17	.28	.26692 ⁷³⁷	10 40 56 ⁷⁶⁴
5	15 31 15.516 ^{8.843}	17 19 57.95 ^{30.47}	.17	.28	.26173 ⁷⁸⁹	10 37 09 ⁸¹⁶
6	15 31 24.359 ^{+8.801}	-17 20 28.42 ^{-30.23}	1.17	0.28	31.25626 ⁻	10 33 22 ⁸⁴¹
7	15 31 33.160 ^{8.756}	17 20 58.65 ^{29.99}	.17	.28	.25051 ⁸⁶⁷	10 29 35 ⁸⁹²
8	15 31 41.916 ^{8.712}	17 21 28.64 ^{29.74}	.17	.28	.24449 ⁹¹⁷	10 25 48 ⁹⁴²
9	15 31 50.628 ^{8.666}	17 21 58.38 ^{29.47}	.17	.28	.23819 ⁹⁶⁷	10 22 00 ⁹⁹¹
10	15 31 59.294 ^{8.619}	17 22 27.85 ^{29.21}	.17	.28	.23163 ¹⁰¹⁵	10 18 13 ¹⁰³⁹
11	15 32 07.913 ^{+8.571}	-17 22 57.06 ^{-28.95}	1.17	0.28	31.22479 ⁻	10 14 26 ¹⁰⁶²
12	15 32 16.484 ^{8.523}	17 23 26.01 ^{28.69}	.17	.28	.21768 ⁹⁶⁷	10 10 38 ⁹⁹¹
13	15 32 25.007 ^{8.473}	17 23 54.70 ^{28.42}	.17	.28	.21031 ¹⁰¹⁵	10 06 51 ¹⁰³⁹
14	15 32 33.480 ^{8.421}	17 24 23.12 ^{28.16}	.17	.28	.20267 ⁸¹⁶	10 03 03 ⁸⁴¹
15	15 32 41.901 ^{8.368}	17 24 51.28 ^{27.91}	.17	.28	.19478 ⁸⁶⁷	9 59 16 ⁸⁹²
16	15 32 50.269 ^{+8.310}	-17 25 19.19 ^{-27.63}	1.17	0.28	31.18662 ⁻	9 55 28 ⁹¹⁷
17	15 32 58.579 ^{8.252}	17 25 46.82 ^{27.36}	.17	.28	.17821 ⁹⁴²	9 51 40 ⁹⁶⁷
18	15 33 06.831 ^{8.189}	17 26 14.18 ^{27.09}	.17	.28	.16954 ⁹⁹¹	9 47 53 ¹⁰¹⁵
19	15 33 15.020 ^{8.124}	17 26 41.27 ^{26.80}	.17	.28	.16062 ¹⁰³⁹	9 44 05 ¹⁰⁶²
20	15 33 23.144 ^{8.055}	17 27 08.07 ^{26.49}	.17	.28	.15145 ⁹⁶⁷	9 40 17 ⁹⁹¹
21	15 33 31.199 ^{+7.985}	-17 27 34.56 ^{-26.18}	1.17	0.28	31.14203 ⁻	9 36 29 ¹⁰¹⁵
22	15 33 39.184 ^{7.912}	17 28 00.74 ^{25.85}	.17	.28	.13236 ¹⁰³⁹	9 32 41 ¹⁰⁶²
23	15 33 47.096 ^{7.839}	17 28 26.59 ^{25.50}	.17	.28	.12245 ⁹⁶⁷	9 28 53 ⁹⁹¹
24	15 33 54.935 ^{7.764}	17 28 52.09 ^{25.16}	.18	.28	.11230 ¹⁰¹⁵	9 25 05 ¹⁰³⁹
25	15 34 02.699 ^{7.690}	17 29 17.25 ^{24.80}	.18	.28	.10191 ¹⁰⁶²	9 21 17 ⁹⁶⁷
26	15 34 10.389 ^{+7.615}	-17 29 42.05 ^{-24.45}	1.18	0.28	31.09129 ⁻	9 17 28 ¹⁰¹⁵
27	15 34 18.004 ^{7.539}	17 30 06.50 ^{24.12}	.18	.28	.08043 ⁹⁶⁷	9 13 40 ⁹⁹¹
28	15 34 25.543 ^{7.463}	17 30 30.62 ^{23.78}	.18	.28	.06934 ¹⁰¹⁵	9 09 52 ¹⁰³⁹
29	15 34 33.006 ^{7.382}	17 30 54.40 ^{23.44}	.18	.28	.05802 ¹⁰⁶²	9 06 03 ⁹⁶⁷
30	15 34 40.388 ^{7.297}	17 31 17.84 ^{23.11}	.18	.28	.04648 ⁹⁹¹	9 02 15 ¹⁰¹⁵
31	15 34 47.685 ^{+7.208}	-17 31 40.95 ^{-22.76}	1.18	0.28	31.03472 ⁻	8 58 26 ¹⁰³⁹
32	15 34 54.893	-17 32 03.71	1.18	0.28	31.02274 ⁻	8 54 37 ¹⁰⁶²

PLUTO, 1967

FOR 0^h EPHEMERIS TIME

Date	Astrometric Right Ascension 1950.0	Astrometric Declination 1950.0	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]		^h ^m
Jan. -2	11 49 08.473 - 0.173	+17 30 07.15 +135.78	0.28	31.98965 -6602	5 21
2	11 49 08.300 2.149	17 32 22.93 146.00	.28	.92363 6440	5 05
6	11 49 06.151 4.109	17 34 48.93 155.46	.28	.85923 6244	4 50
10	11 49 02.042 6.031	17 37 24.39 164.04	.28	.79679 6017	4 34
14	11 48 56.011 7.901	17 40 08.43 171.59	.28	.73662 5758	4 18
18	11 48 48.110 - 9.704	+17 43 00.02 +178.11	0.28	31.67904 -5470	4 02
22	11 48 38.406 11.430	17 45 58.13 183.56	.28	.62434 5158	3 46
26	11 48 26.976 13.077	17 49 01.69 187.99	.28	.57276 4822	3 30
30	11 48 13.899 14.642	17 52 09.68 191.35	.28	.52454 4463	3 14
Feb. 3	11 47 59.257 16.115	17 55 21.03 193.62	.28	.47991 4082	2 58
7	11 47 43.142 -17.477	+17 58 34.65 +194.70	0.28	31.43909 -3679	2 42
11	11 47 25.665 18.716	18 01 49.35 194.55	.28	.40230 3257	2 26
15	11 47 06.949 19.821	18 05 03.90 193.17	.28	.36973 2821	2 10
19	11 46 47.128 20.788	18 08 17.07 190.61	.28	.34152 2374	1 54
23	11 46 26.340 21.620	18 11 27.68 186.97	.28	.31778 1920	1 38
27	11 46 04.720 -22.317	+18 14 34.65 +182.28	0.28	31.29858 -1457	1 22
Mar. 3	11 45 42.403 22.874	18 17 36.93 176.54	.28	.28401 988	1 06
7	11 45 19.529 23.279	18 20 33.47 169.70	.28	.27413 514	0 50
11	11 44 56.250 23.524	18 23 23.17 161.80	.28	.26899 - 40	0 34
15	11 44 32.726 23.609	18 26 04.97 152.92	.28	.26859 + 432	0 18
19	11 44 09.117 -23.538	+18 28 37.89 +143.16	0.28	31.27291 + 895	0 02
23	11 43 45.579 23.318	18 31 01.05 132.63	.28	.28186 1351	23 41
27	11 43 22.261 22.960	18 33 13.68 121.45	.28	.29537 1797	23 25
31	11 42 59.301 22.462	18 35 15.13 109.61	.28	.31334 2232	23 09
Apr. 4	11 42 36.839 21.819	18 37 04.74 97.12	.28	.33566 2655	22 53
8	11 42 15.020 -21.033	+18 38 41.86 + 84.05	0.28	31.36221 +3064	22 37
12	11 41 53.987 20.110	18 40 05.91 70.53	.28	.39285 3453	22 21
16	11 41 33.877 19.058	18 41 16.44 56.64	.28	.42738 3820	22 05
20	11 41 14.819 17.896	18 42 13.08 42.56	.28	.46558 4164	21 49
24	11 40 56.923 16.636	18 42 55.64 28.35	.28	.50722 4487	21 33
28	11 40 40.287 -15.279	+18 43 23.99 + 14.02	0.28	31.55209 +4787	21 17
May 2	11 40 25.008 13.826	18 43 38.01 - 0.40	.28	.59996 5064	21 01
6	11 40 11.182 12.281	18 43 37.61 14.86	.28	.65060 5315	20 45
10	11 39 58.901 10.657	18 43 22.75 29.24	.28	.70375 5537	20 29
14	11 39 48.244 8.966	18 42 53.51 43.43	.28	.75912 5730	20 13
18	11 39 39.278 - 7.226	+18 42 10.08 - 57.33	0.28	31.81642 +5893	19 57
22	11 39 32.052 5.450	18 41 12.75 70.87	.28	.87535 6027	19 41
26	11 39 26.602 3.640	18 40 01.88 84.07	.28	.93562 6135	19 26
30	11 39 22.962 - 1.797	18 38 37.81 96.95	.28	31.99697 6216	19 10
June 3	+ 0.074	18 37 00.86 109.42	.27	32.05913 6265	18 54
7	11 39 21.239 + 1.960	+18 35 11.44 -121.43	0.27	32.12178 +6286	18 38
11	11 39 23.199 3.849	18 33 10.01 132.88	.27	.18464 6274	18 23
15	11 39 27.048 5.721	18 30 57.13 143.68	.27	.24738 6233	18 07
19	11 39 32.769 7.572	18 28 33.45 153.82	.27	.30971 6165	17 51
23	11 39 40.341 9.398	18 25 59.63 163.36	.27	.37136 6070	17 36
27	11 39 49.739 +11.203	+18 23 16.27 -172.29	0.27	32.43206 +5950	17 20
July 1	11 40 00.942	+18 20 23.98	0.27	32.49156	17 05

Double transit, March 19

FOR 0^h EPHEMERIS TIME

Date		Astrometric Right Ascension 1950.0		Astrometric Declination 1950.0		Hor. Par.	True Distance from the Earth	Ephem- eris Transit				
		h	m	s				h	m			
July	1	11	40	00.942	+12.976	+18 20 23.98	-180.60	0.27	32.49156	+5803	17 05	
	5	11	40	13.918	14.714	18 17 23.38	188.20	.27	.54959	5629	16 49	
	9	11	40	28.632	16.399	18 14 15.18	195.04	.27	.60588	5426	16 34	
	13	11	40	45.031	18.021	18 11 00.14	201.05	.27	.66014	5200	16 18	
	17	11	41	03.052	19.575	18 07 39.09	206.27	.27	.71214	4952	16 03	
	21	11	41	22.627	+21.061	+18 04 12.82	-210.75	0.27	32.76166	+4684	15 48	
	25	11	41	43.688	22.483	18 00 42.07	214.52	.27	.80850	4397	15 32	
	29	11	42	06.171	23.836	17 57 07.55	217.54	.27	.85247	4088	15 17	
	Aug.	2	11	42	30.007	25.114	17 53 30.01	219.76	.27	.89335	3760	15 01
		6	11	42	55.121	26.304	17 49 50.25	221.15	.27	.93095	3413	14 46
	10	11	43	21.425	+27.395	+17 46 09.10	-221.65	0.27	32.96508	+3049	14 31	
	14	11	43	48.820	28.389	17 42 27.45	221.32	.27	32.99557	2674	14 16	
	18	11	44	17.209	29.288	17 38 46.13	220.23	.27	33.02231	2287	14 00	
	22	11	44	46.497	30.096	17 35 05.90	218.39	.27	.04518	1889	13 45	
	26	11	45	16.593	30.810	17 31 27.51	215.80	.27	.06407	1482	13 30	
Sept.	30	11	45	47.403	+31.423	+17 27 51.71	-212.42	0.27	33.07889	+1064	13 15	
	3	11	46	18.826	31.925	17 24 19.29	208.20	.27	.08953	637	12 59	
	7	11	46	50.751	32.311	17 20 51.09	203.12	.27	.09590	+ 207	12 44	
	11	11	47	23.062	32.580	17 17 27.97	197.28	.27	.09797	- 226	12 29	
	15	11	47	55.642	32.742	17 14 10.69	190.72	.27	.09571	657	12 14	
	19	11	48	28.384	+32.798	+17 10 59.97	-183.51	0.27	33.08914	-1087	11 59	
	23	11	49	01.182	32.746	17 07 56.46	175.60	.27	.07827	1517	11 44	
	27	11	49	33.928	32.582	17 05 00.86	167.00	.27	.06310	1945	11 28	
	Oct.	1	11	50	06.510	32.300	17 02 13.86	157.67	.27	.04365	2367	11 13
		5	11	50	38.810	31.893	16 59 36.19	147.61	.27	33.01998	2782	10 58
	9	11	51	10.703	+31.367	+16 57 08.58	-136.95	0.27	32.99216	-3185	10 43	
	13	11	51	42.070	30.731	16 54 51.63	125.76	.27	.96031	3575	10 28	
	17	11	52	12.801	29.990	16 52 45.87	114.09	.27	.92456	3951	10 12	
	21	11	52	42.791	29.146	16 50 51.78	101.93	.27	.88505	4313	9 57	
	25	11	53	11.937	28.192	16 49 09.85	89.30	.27	.84192	4661	9 42	
Nov.	29	11	53	40.129	+27.128	+16 47 40.55	- 76.20	0.27	32.79531	-4990	9 27	
	2	11	54	07.257	25.950	16 46 24.35	62.66	.27	.74541	5300	9 11	
	6	11	54	33.207	24.668	16 45 21.69	48.81	.27	.69241	5583	8 56	
	10	11	54	57.875	23.297	16 44 32.88	34.77	.27	.63658	5843	8 41	
	14	11	55	21.172	21.841	16 43 58.11	20.61	.27	.57815	6077	8 25	
	18	11	55	43.013	+20.304	+16 43 37.50	- 6.32	0.27	32.51738	-6286	8 10	
	22	11	56	03.317	18.687	16 43 31.18	+ 8.05	.27	.45452	6470	7 55	
	26	11	56	22.004	16.989	16 43 39.23	22.47	.27	.38982	6624	7 39	
	30	11	56	38.993	15.214	16 44 01.70	36.89	.27	.32358	6748	7 24	
	Dec.	4	11	56	54.207	13.376	16 44 38.59	51.11	.27	.25610	6839	7 08
	8	11	57	07.583	+11.493	+16 45 29.70	+ 65.05	0.27	32.18771	-6897	6 53	
	12	11	57	19.076	9.574	16 46 34.75	78.62	.27	.11874	6922	6 37	
	16	11	57	28.650	7.625	16 47 53.37	91.78	.27	32.04952	6917	6 22	
	20	11	57	36.275	5.650	16 49 25.15	104.51	.28	31.98035	6879	6 06	
	24	11	57	41.925	3.651	16 51 09.66	116.77	.28	.91156	6811	5 50	
	28	11	57	45.576	+ 1.640	+16 53 06.43	+128.46	0.28	31.84345	-6707	5 35	
	32	11	57	47.216		+16 55 14.89		0.28	31.77638		5 19	

CERES, 1967
FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]	["]		^h ^m ^s
Jan. 0	5 50 05.02 - 61.11	+I 04.35	+26 45 37.0 +207.9	+0 20.5	5.27	1.670 813	23 10 29
1	5 49 03.91 - 60.47	04.38	26 49 04.9 +203.7	0 22.1	5.26	.672 849	23 05 33
2*	5 48 03.44 - 59.74	04.41	26 52 28.6 +199.6	0 23.7	5.25	.675 167	23 00 38
3	5 47 03.70 - 58.96	04.43	26 55 48.2 +195.5	0 25.2	5.25	.677 768	22 55 43
4	5 46 04.74 - 58.08	04.46	26 59 03.7 +191.4	0 26.7	5.24	.680 648	22 50 49
5	5 45 06.66 - 57.14	+I 04.48	+27 02 15.1 +187.2	+0 28.2	5.23	1.683 807	22 45 57
6	5 44 09.52 - 56.13	04.50	27 05 22.3 +183.2	0 29.6	5.22	.687 241	22 41 05
7	5 43 13.39 - 55.04	04.53	27 08 25.5 +179.1	0 31.0	5.20	.690 948	22 36 14
8	5 42 18.35 - 53.89	04.56	27 11 24.6 +175.1	0 32.4	5.19	.694 926	22 31 25
9	5 41 24.46 - 52.67	04.59	27 14 19.7 +171.3	0 33.8	5.18	.699 171	22 26 36
10	5 40 31.79 - 51.39	+I 04.62	+27 17 11.0 +167.3	+0 35.2	5.17	1.703 680	22 21 49
11	5 39 40.40 - 50.04	04.65	27 19 58.3 +163.6	0 36.5	5.15	.708 449	22 17 04
12	5 38 50.36 - 48.64	04.67	27 22 41.9 +159.8	0 37.9	5.14	.713 476	22 12 19
13	5 38 01.72 - 47.18	04.69	27 25 21.7 +156.3	0 39.2	5.12	.718 755	22 07 36
14	5 37 14.54 - 45.68	04.70	27 27 58.0 +152.7	0 40.4	5.10	.724 283	22 02 55
15*	5 36 28.86 - 44.12	+I 04.71	+27 30 30.7 +149.3	+0 41.7	5.09	1.730 056	21 58 15
16	5 35 44.74 - 42.52	04.72	27 33 00.0 +146.1	0 42.8	5.07	.736 068	21 53 37
17	5 35 02.22 - 40.89	04.72	27 35 26.1 +142.7	0 43.9	5.05	.742 317	21 49 00
18	5 34 21.33 - 39.20	04.73	27 37 48.8 +139.7	0 45.0	5.03	.748 796	21 44 25
19	5 33 42.13 - 37.49	04.73	27 40 08.5 +136.7	0 46.0	5.01	.755 503	21 39 52
20	5 33 04.64 - 35.74	+I 04.74	+27 42 25.2 +133.8	+0 46.9	4.99	1.762 431	21 35 20
21	5 32 28.90 - 33.98	04.75	27 44 39.0 +131.0	0 47.8	4.97	.769 577	21 30 50
22	5 31 54.92 - 32.17	04.76	27 46 50.0 +128.4	0 48.7	4.95	.776 935	21 26 22
23	5 31 22.75 - 30.35	04.77	27 48 58.4 +125.8	0 49.5	4.93	.784 501	21 21 56
24	5 30 52.40 - 28.51	04.79	27 51 04.2 +123.3	0 50.3	4.91	.792 270	21 17 31
25	5 30 23.89 - 26.66	+I 04.80	+27 53 07.5 +121.0	+0 51.1	4.89	1.800 238	21 13 09
26	5 29 57.23 - 24.78	04.82	27 55 08.5 +118.7	0 51.8	4.87	.808 400	21 08 48
27	5 29 32.45 - 22.89	04.83	27 57 07.2 +116.6	0 52.6	4.84	.816 752	21 04 29
28	5 29 09.56 - 21.00	04.83	27 59 03.8 +114.5	0 53.2	4.82	.825 288	21 00 12
29*	5 28 48.56 - 19.10	04.83	28 00 58.3 +112.6	0 53.8	4.80	.834 006	20 55 57
30	5 28 29.46 - 17.17	+I 04.83	+28 02 50.9 +110.7	+0 54.4	4.78	1.842 900	20 51 44
31	5 28 12.29 - 15.25	04.82	28 04 41.6 +109.0	0 54.8	4.75	.851 967	20 47 33
Feb. 1	5 27 57.04 - 13.32	04.82	28 06 30.6 +107.3	0 55.2	4.73	.861 201	20 43 23
2	5 27 43.72 - 11.38	04.82	28 08 17.9 +105.7	0 55.6	4.70	.870 600	20 39 16
3	5 27 32.34 - 9.44	04.83	28 10 03.6 +104.2	0 55.8	4.68	.880 158	20 35 10
4	5 27 22.90 - 7.49	+I 04.84	+28 11 47.8 +102.8	+0 56.1	4.66	1.889 871	20 31 06
5	5 27 15.41 - 5.55	04.85	28 13 30.6 +101.5	0 56.3	4.63	.899 735	20 27 05
6	5 27 09.86 - 3.60	04.86	28 15 12.1 +100.2	0 56.5	4.61	.909 744	20 23 05
7	5 27 06.26 - 1.66	04.86	28 16 52.3 +99.0	0 56.6	4.58	.919 895	20 19 07
8	5 27 04.60 + 0.29	04.87	28 18 31.3 +97.9	0 56.7	4.56	.930 183	20 15 11
9	5 27 04.89 + 2.21	+I 04.87	+28 20 09.2 +96.8	+0 56.8	4.54	1.940 602	20 11 17
10	5 27 07.10 + 4.14	04.87	28 21 46.0 +95.8	0 56.8	4.51	.951 148	20 07 25
11*	5 27 11.24 + 6.06	04.87	28 23 21.8 +94.8	0 56.8	4.49	.961 817	20 03 35
12	5 27 17.30 + 7.96	04.87	28 24 56.6 +93.8	0 56.7	4.46	.972 604	19 59 47
13	5 27 25.26 + 9.85	04.86	28 26 30.4 +93.0	0 56.6	4.44	.983 504	19 56 00
14	5 27 35.11 + 11.73	+I 04.85	+28 28 03.4 +92.0	+0 56.3	4.41	1.994 513	19 52 16
15	5 27 46.84 + 11.73	+I 04.85	+28 29 35.4 +92.0	+0 56.1	4.39	2.005 625	19 48 33

Photographic Magnitude : Jan. 10, 7.3 ; Jan. 30, 7.4

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	[°] ['] ["]			^h ^m ^s
Feb. 15	5 27 46.84	+1 04.85	+28 29 35.4	+0 56.1	4.39	2.005 625	19 48 33
16	5 28 00.43	04.85	28 31 06.6	0 55.7	4.36	.016 837	19 44 52
17	5 28 15.87	04.85	28 32 37.0	0 55.3	4.34	.028 145	19 41 13
18	5 28 33.13	04.85	28 34 06.6	0 54.9	4.32	.039 543	19 37 36
19	5 28 52.21	04.86	28 35 35.3	0 54.4	4.29	.051 028	19 34 00
20	5 29 13.07	+1 04.86	+28 37 03.2	+0 53.9	4.27	2.062 596	19 30 27
21	5 29 35.71	04.87	28 38 30.3	0 53.4	4.24	.074 243	19 26 55
22	5 30 00.09	04.88	28 39 56.5	0 52.9	4.22	.085 965	19 23 24
23	5 30 26.20	04.89	28 41 22.0	0 52.3	4.20	.097 757	19 19 56
24	5 30 54.01	04.89	28 42 46.5	0 51.7	4.17	.109 618	19 16 29
25*	5 31 23.51	+1 04.89	+28 44 10.2	+0 51.1	4.15	2.121 543	19 13 04
26	5 31 54.67	04.89	28 45 33.0	0 50.3	4.13	.133 530	19 09 40
27	5 32 27.48	04.88	28 46 54.9	0 49.6	4.10	.145 575	19 06 18
28	5 33 01.91	04.88	28 48 15.9	0 48.7	4.08	.157 675	19 02 58
Mar. 1	5 33 37.94	04.88	28 49 35.9	0 47.8	4.06	.169 827	18 59 39
2	5 34 15.56	+1 04.88	+28 50 54.8	+0 46.8	4.03	2.182 029	18 56 22
3	5 34 54.74	04.89	28 52 12.8	0 45.8	4.01	.194 277	18 53 06
4	5 35 35.48	04.90	28 53 29.7	0 44.8	3.99	.206 568	18 49 52
5	5 36 17.75	04.90	28 54 45.5	0 43.8	3.97	.218 898	18 46 39
6	5 37 01.53	04.91	28 56 00.2	0 42.8	3.94	.231 266	18 43 28
7	5 37 46.80	+1 04.92	+28 57 13.7	+0 41.7	3.92	2.243 667	18 40 18
8	5 38 33.55	04.92	28 58 26.0	0 40.6	3.90	.256 098	18 37 10
9	5 39 21.76	04.92	28 59 37.1	0 39.5	3.88	.268 556	18 34 03
10	5 40 11.39	04.92	29 00 46.8	0 38.3	3.86	.281 038	18 30 58
11*	5 41 02.45	04.92	29 01 55.2	0 37.1	3.84	.293 542	18 27 54
12	5 41 54.89	+1 04.91	+29 03 02.2	+0 35.8	3.82	2.306 062	18 24 51
13	5 42 48.71	04.90	29 04 07.7	0 34.5	3.80	.318 598	18 21 50
14	5 43 43.88	04.89	29 05 11.7	0 33.1	3.78	.331 146	18 18 50
15	5 44 40.38	04.89	29 06 14.1	0 31.7	3.76	.343 702	18 15 51
16	5 45 38.18	04.89	29 07 14.9	0 30.2	3.74	.356 264	18 12 54
17	5 46 37.28	+1 04.89	+29 08 14.0	+0 28.7	3.72	2.368 830	18 09 57
18	5 47 37.63	04.89	29 09 11.3	0 27.2	3.70	.381 396	18 07 03
19	5 48 39.23	04.90	29 10 06.8	0 25.7	3.68	.393 961	18 04 09
20	5 49 42.04	04.90	29 11 00.4	0 24.1	3.66	.406 521	18 01 16
21	5 50 46.06	04.91	29 11 52.1	0 22.5	3.64	.419 074	17 58 25
22	5 51 51.24	+1 04.91	+29 12 41.7	+0 21.0	3.62	2.431 618	17 55 35
23	5 52 57.58	04.91	29 13 29.3	0 19.4	3.60	.444 151	17 52 46
24	5 54 05.05	04.91	29 14 14.7	0 17.8	3.58	.456 670	17 49 58
25*	5 55 13.63	04.90	29 14 57.9	0 16.1	3.56	.469 176	17 47 11
26	5 56 23.30	04.89	29 15 38.9	0 14.4	3.55	.481 664	17 44 25
27	5 57 34.05	+1 04.88	+29 16 17.5	+0 12.7	3.53	2.494 135	17 41 41
28	5 58 45.84	04.87	29 16 53.6	0 10.9	3.51	.506 585	17 38 57
29	5 59 58.67	04.87	29 17 27.4	0 09.0	3.49	.519 015	17 36 14
30	6 01 12.52	04.87	29 17 58.5	0 07.1	3.48	.531 422	17 33 32
31	6 02 27.37	04.87	29 18 27.1	0 05.2	3.46	.543 804	17 30 52
Apr. 1	6 03 43.22	+1 04.87	+29 18 53.1	+0 03.3	3.44	2.556 160	17 28 12
2	6 05 00.03	+1 04.87	+29 19 16.3	+0 01.4	3.43	2.568 488	17 25 33

Photographic Magnitude : Feb. 19, 7.6 ; Mar. 11, 7.9 ; Mar. 31, 8.1

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

CERES, 1967

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]	["]		^h ^m ^s
Apr. 1	6 03 43.22 + 76.81	+1 04.87	+29 18 53.1 + 23.2	+0 03.3	3.44	2.556 160	17 28 12
2	6 05 00.03 + 77.77	04.87	29 19 16.3 + 20.4	+0 01.4	3.43	.568 488	17 25 33
3	6 06 17.80 + 78.71	04.87	29 19 36.7 + 17.6	-0 00.5	3.41	.580 786	17 22 56
4	6 07 36.51 + 79.64	04.86	29 19 54.3 + 14.7	0 02.4	3.39	.593 052	17 20 19
5	6 08 56.15 + 80.55	04.85	29 20 09.0 + 11.7	0 04.3	3.38	.605 285	17 17 43
6	6 10 16.70 + 81.44	+1 04.84	+29 20 20.7 + 8.7	-0 06.3	3.36	2.617 482	17 15 08
7	6 11 38.14 + 82.32	04.82	29 20 29.4 + 5.6	0 08.3	3.35	.629 641	17 12 33
8*	6 13 00.46 + 83.18	04.81	29 20 35.0 + 2.5	0 10.3	3.33	.641 762	17 10 00
9	6 14 23.64 + 84.03	04.79	29 20 37.5 - 0.7	0 12.3	3.32	.653 841	17 07 27
10	6 15 47.67 + 84.85	04.77	29 20 36.8 - 4.0	0 14.4	3.30	.665 877	17 04 56
11	6 17 12.52 + 85.66	+1 04.75	+29 20 32.8 - 7.3	-0 16.5	3.29	2.677 869	17 02 25
12	6 18 38.18 + 86.46	04.73	29 20 25.5 - 10.7	0 18.7	3.27	.689 814	16 59 55
13	6 20 04.64 + 87.24	04.71	29 20 14.8 - 14.2	0 20.9	3.26	.701 711	16 57 26
14	6 21 31.88 + 88.00	04.70	29 20 00.6 - 17.6	0 23.1	3.24	.713 558	16 54 57
15	6 22 59.88 + 88.75	04.69	29 19 43.0 - 21.2	0 25.3	3.23	.725 354	16 52 29
16	6 24 28.63 + 89.47	+1 04.68	+29 19 21.8 - 24.8	-0 27.5	3.22	2.737 097	16 50 02
17	6 25 58.10 + 90.18	04.67	29 18 57.0 - 28.4	0 29.7	3.20	.748 786	16 47 36
18	6 27 28.28 + 90.88	04.66	29 18 28.6 - 32.1	0 31.9	3.19	.760 420	16 45 10
19	6 28 59.16 + 91.55	04.64	29 17 56.5 - 35.9	0 34.1	3.18	.771 997	16 42 45
20	6 30 30.71 + 92.22	04.62	29 17 20.6 - 39.7	0 36.3	3.16	.783 516	16 40 21
21	6 32 02.93 + 92.86	+1 04.59	+29 16 40.9 - 43.6	-0 38.5	3.15	2.794 976	16 37 57
22*	6 33 35.79 + 93.49	04.56	29 15 57.3 - 47.4	0 40.8	3.14	.806 377	16 35 34
23	6 35 09.28 + 94.12	04.53	29 15 09.9 - 51.5	0 43.1	3.12	.817 717	16 33 12
24	6 36 43.40 + 94.71	04.50	29 14 18.4 - 55.4	0 45.4	3.11	.828 997	16 30 50
25	6 38 18.11 + 95.31	04.47	29 13 23.0 - 59.4	0 47.8	3.10	.840 215	16 28 29
26	6 39 53.42 + 95.89	+1 04.45	+29 12 23.6 - 63.5	-0 50.2	3.09	2.851 371	16 26 08
27	6 41 29.31 + 96.46	04.43	29 11 20.1 - 67.7	0 52.6	3.07	.862 463	16 23 48
28	6 43 05.77 + 97.02	04.41	29 10 12.4 - 71.8	0 55.0	3.06	.873 492	16 21 28
29	6 44 42.79 + 97.56	04.39	29 09 00.6 - 76.0	0 57.4	3.05	.884 456	16 19 09
30	6 46 20.35 + 98.11	04.36	29 07 44.6 - 80.3	0 59.7	3.04	.895 355	16 16 51
May 1	6 47 58.46 + 98.63	+1 04.34	+29 06 24.3 - 84.5	-1 02.1	3.03	2.906 186	16 14 33
2	6 49 37.09 + 99.14	04.30	29 04 59.8 - 88.9	1 04.5	3.02	.916 950	16 12 16
3	6 51 16.23 + 99.65	04.27	29 03 30.9 - 93.2	1 06.8	3.01	.927 645	16 09 59
4	6 52 55.88 + 100.14	04.23	29 01 57.7 - 97.7	1 09.2	3.00	.938 270	16 07 42
5	6 54 36.02 + 100.62	04.19	29 00 20.0 - 102.0	1 11.6	2.98	.948 824	16 05 27
6*	6 56 16.64 + 101.10	+1 04.14	+28 58 38.0 - 106.6	-1 14.0	2.97	2.959 305	16 03 11
7	6 57 57.74 + 101.55	04.09	28 56 51.4 - 111.0	1 16.5	2.96	.969 713	16 00 56
8	6 59 39.29 + 101.99	04.05	28 55 00.4 - 115.5	1 19.0	2.95	.980 046	15 58 42
9	7 01 21.28 + 102.44	04.00	28 53 04.9 - 120.1	1 21.4	2.94	2.990 304	15 56 27
10	7 03 03.72 + 102.85	03.96	28 51 04.8 - 124.7	1 23.9	2.93	3.000 485	15 54 14
11	7 04 46.57 + 103.26	+1 03.92	+28 49 00.1 - 129.2	-1 26.5	2.92	3.010 588	15 52 00
12	7 06 29.83 + 103.66	03.88	28 46 50.9 - 133.9	1 29.0	2.91	.020 612	15 49 48
13	7 08 13.49 + 104.05	03.84	28 44 37.0 - 138.6	1 31.5	2.90	.030 557	15 47 35
14	7 09 57.54 + 104.42	03.80	28 42 18.4 - 143.2	1 34.0	2.89	.040 422	15 45 23
15	7 11 41.96 + 104.78	03.76	28 39 55.2 - 147.9	1 36.4	2.89	.050 205	15 43 11
16	7 13 26.74 + 105.14	+1 03.72	+28 37 27.3 - 152.6	-1 38.9	2.88	3.059 906	15 41 00
17	7 15 11.88 + 105.51	+1 03.67	+28 34 54.7 - 157.3	-1 41.3	2.87	3.069 524	15 38 49

Photographic Magnitude : Apr. 20, 8.3 ; May 10, 8.4

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

CERES, 1967

FOR 0^h EPHEMERIS TIME

239

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]	["]		^h ^m ^s
May 17	7 15 11.88 ^s	+1 03.67	+28 34 54.7 ["]	-1 41.3	2.87	3.069 524	15 38 49
18	7 16 57.34 ^{+105.46}	03.62	28 32 17.4 ^{-157.3}	1 43.8	2.86	.079 059	15 36 38
19	7 18 43.14 ^{105.80}	03.56	28 29 35.3 ^{162.1}	1 46.2	2.85	.088 511	15 34 28
20	7 20 29.25 ^{106.11}	03.50	28 26 48.5 ^{166.8}	1 48.7	2.84	.097 878	15 32 18
21*	7 22 15.66 ^{106.41}	03.44	28 23 56.9 ^{171.6}	1 51.2	2.83	.107 162	15 30 08
	^{106.71}		^{176.4}				
22	7 24 02.37 ^{+106.99}	+1 03.38	+28 21 00.5 ^{-181.1}	-1 53.8	2.82	3.116 361	15 27 58
23	7 25 49.36 ^{107.27}	03.33	28 17 59.4 ^{186.0}	1 56.3	2.82	.125 476	15 25 49
24	7 27 36.63 ^{107.53}	03.28	28 14 53.4 ^{190.7}	1 58.9	2.81	.134 506	15 23 40
25	7 29 24.16 ^{107.80}	03.23	28 11 42.7 ^{195.6}	2 01.4	2.80	.143 451	15 21 31
26	7 31 11.96 ^{108.05}	03.18	28 08 27.1 ^{200.5}	2 03.9	2.79	.152 311	15 19 23
27	7 33 00.01 ^{+108.30}	+1 03.13	+28 05 06.6 ^{-205.2}	-2 06.4	2.78	3.161 085	15 17 15
28	7 34 48.31 ^{108.54}	03.07	28 01 41.4 ^{210.2}	2 08.9	2.78	.169 773	15 15 07
29	7 36 36.85 ^{108.78}	03.02	27 58 11.2 ^{215.0}	2 11.4	2.77	.178 375	15 12 59
30	7 38 25.63 ^{109.00}	02.95	27 54 36.2 ^{219.9}	2 13.8	2.76	.186 889	15 10 51
31	7 40 14.63 ^{109.21}	02.89	27 50 56.3 ^{224.7}	2 16.3	2.75	.195 314	15 08 44
June 1	7 42 03.84 ^{+109.43}	+1 02.81	+27 47 11.6 ^{-229.6}	-2 18.7	2.75	3.203 651	15 06 37
2	7 43 53.27 ^{109.63}	02.74	27 43 22.0 ^{234.5}	2 21.2	2.74	.211 899	15 04 30
3	7 45 42.90 ^{109.83}	02.67	27 39 27.5 ^{239.4}	2 23.6	2.73	.220 056	15 02 23
4*	7 47 32.73 ^{110.01}	02.59	27 35 28.1 ^{244.3}	2 26.1	2.73	.228 123	15 00 17
5	7 49 22.74 ^{110.19}	02.52	27 31 23.8 ^{249.1}	2 28.6	2.72	.236 097	14 58 11
6	7 51 12.93 ^{+110.37}	+1 02.45	+27 27 14.7 ^{-254.0}	-2 31.1	2.71	3.243 980	14 56 04
7	7 53 03.30 ^{110.52}	02.38	27 23 00.7 ^{258.9}	2 33.6	2.71	.251 769	14 53 58
8	7 54 53.82 ^{110.68}	02.31	27 18 41.8 ^{263.7}	2 36.1	2.70	.259 464	14 51 53
9	7 56 44.50 ^{+110.83}	02.25	27 14 18.1 ^{-268.6}	2 38.5	2.69	.267 065	14 49 47
10	7 58 35.33	+1 02.18	+27 09 49.5	-2 41.0	2.69	3.274 571	14 47 41
Nov. 10	12 30 44.08 ^{+95.12}	+0 53.09	+ 5 54 03.4 ^{-521.2}	-5 48.1	2.75	3.198 372	9 16 51
11	12 32 19.20 ^{94.87}	53.09	5 45 22.2 ^{518.2}	5 47.9	2.76	.189 824	9 14 30
12	12 33 54.07 ^{94.61}	53.10	5 36 44.0 ^{515.0}	5 47.7	2.77	.181 184	9 12 08
13	12 35 28.68 ^{94.36}	53.10	5 28 09.0 ^{512.0}	5 47.5	2.77	.172 454	9 09 46
14	12 37 03.04 ^{94.10}	53.11	5 19 37.0 ^{508.8}	5 47.3	2.78	.163 634	9 07 24
15	12 38 37.14 ^{+93.84}	+0 53.11	+ 5 11 08.2 ^{-505.5}	-5 47.1	2.79	3.154 724	9 05 02
16	12 40 10.98	+0 53.12	+ 5 02 42.7	-5 46.8	2.80	3.145 726	9 02 39

Photographic Magnitude : May 30, 8.6 ; June 19, 8.7 ; Nov. 6, 8.6

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

CERES, 1967

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
Nov. 16	^{h m s} 12 40 10.98 ^s	^{m s} +0 53.12	^{° ' "} + 5 02 42.7 ["]	^{' "} -5 46.8 ["]	2.80	3.145 726	^{h m s} 9 02 39
17	12 41 44.55 ⁺ 93.57	53.13	4 54 20.5 ^{-502.2}	5 46.6 ^{498.8}	2.81	.136 640	9 00 16
18	12 43 17.85 ^{93.30}	53.15	4 46 01.7 ^{495.4}	5 46.3 ^{491.9}	2.81	.127 465	8 57 53
19	12 44 50.88 ^{92.75}	53.17	4 37 46.3 ^{488.3}	5 46.1 ^{5 45.9}	2.82	.118 204	8 55 30
20	12 46 23.63 ^{92.47}	53.19	4 29 34.4		2.83	.108 856	8 53 06
21*	12 47 56.10 ⁺ 92.18	+0 53.21	+ 4 21 26.1 ^{-484.7}	-5 45.6 ^{5 45.4}	2.84	3.099 421	8 50 42
22	12 49 28.28 ^{91.90}	53.24	4 13 21.4 ^{480.9}	5 45.1 ^{477.2}	2.85	.089 901	8 48 18
23	12 51 00.18 ^{91.59}	53.26	4 05 20.5 ^{473.3}	5 44.8 ^{469.4}	2.86	.080 295	8 45 54
24	12 52 31.77 ^{91.29}	53.28	3 57 23.3		2.87	.070 605	8 43 29
25	12 54 03.06 ^{90.98}	53.30	3 49 30.0		2.88	.060 830	8 41 04
26	12 55 34.04 ⁺ 90.67	+0 53.32	+ 3 41 40.6 ^{-465.4}	-5 44.1 ^{5 43.7}	2.88	3.050 971	8 38 38
27	12 57 04.71 ^{90.34}	53.34	3 33 55.2 ^{461.3}	5 43.3 ^{457.1}	2.89	.041 028	8 36 12
28	12 58 35.05 ^{90.01}	53.35	3 26 13.9 ^{452.8}	5 42.9 ^{5 42.5}	2.90	.031 004	8 33 46
29	13 00 05.06 ^{89.67}	53.37	3 18 36.8		2.91	.020 897	8 31 20
30	13 01 34.73 ^{89.32}	53.40	3 11 04.0 ^{448.6}		2.92	.010 710	8 28 53
Dec. 1	13 03 04.05 ⁺ 88.96	+0 53.43	+ 3 03 35.4 ^{-444.1}	-5 42.1 ^{5 41.7}	2.93	3.000 442	8 26 26
2	13 04 33.01 ^{88.61}	53.46	2 56 11.3 ^{439.6}	5 41.3 ^{435.0}	2.94	2.990 096	8 23 59
3	13 06 01.62 ^{88.23}	53.50	2 48 51.7 ^{430.5}	5 40.9 ^{425.8}	2.95	.979 673	8 21 31
4*	13 07 29.85 ^{87.85}	53.53	2 41 36.7		2.96	.969 174	8 19 03
5	13 08 57.70 ^{87.47}	53.57	2 34 26.2 ^{421.0}	-5 40.5 ^{5 39.6}	2.97	.958 601	8 16 34
6	13 10 25.17 ⁺ 87.08	+0 53.60	+ 2 27 20.4 ^{-416.3}	-5 40.1 ^{5 39.1}	2.99	2.947 954	8 14 05
7	13 11 52.25 ^{86.67}	53.63	2 20 19.4 ^{411.4}	5 38.6 ^{406.5}	3.00	.937 235	8 11 36
8	13 13 18.92 ^{86.27}	53.66	2 13 23.1 ^{401.6}	5 38.1 ^{5 37.6}	3.01	.926 446	8 09 06
9	13 14 45.19 ^{85.86}	53.69	2 06 31.7		3.02	.915 588	8 06 36
10	13 16 11.05 ^{85.44}	53.71	1 59 45.2		3.03	.904 661	8 04 06
11	13 17 36.49 ⁺ 85.01	+0 53.74	+ 1 53 03.6 ^{-396.5}	-5 37.6 ^{5 37.0}	3.04	2.893 668	8 01 35
12	13 19 01.50 ^{84.58}	53.77	1 46 27.1 ^{391.5}	5 36.4 ^{5 35.9}	3.05	.882 609	7 59 03
13	13 20 26.08 ^{84.13}	53.80	1 39 55.6 ^{386.4}	5 35.3 ^{381.2}	3.07	.871 486	7 56 31
14	13 21 50.21 ^{83.69}	53.83	1 33 29.2 ^{376.0}		3.08	.860 298	7 53 59
15	13 23 13.90 ^{83.23}	53.87	1 27 08.0		3.09	.849 049	7 51 26
16	13 24 37.13 ⁺ 82.76	+0 53.91	+ 1 20 52.0 ^{-370.7}	-5 34.8 ^{5 34.3}	3.10	2.837 738	7 48 53
17	13 25 59.89 ^{82.29}	53.95	1 14 41.3 ^{365.4}	5 33.7 ^{5 33.2}	3.11	.826 366	7 46 20
18	13 27 22.18 ^{81.81}	53.99	1 08 35.9 ^{359.9}	5 32.6 ^{5 32.1}	3.13	.814 935	7 43 45
19*	13 28 43.99 ^{81.31}	54.03	1 02 36.0 ^{354.5}	-5 32.1 ^{5 31.5}	3.14	.803 446	7 41 11
20	13 30 05.30 ^{80.82}	54.07	0 56 41.5 ^{349.0}	5 30.9 ^{5 30.3}	3.15	.791 900	7 38 36
21	13 31 26.12 ⁺ 80.30	+0 54.11	+ 0 50 52.5 ^{-343.4}	-5 29.0 ^{5 28.3}	3.17	2.780 297	7 36 00
22	13 32 46.42 ^{79.77}	54.15	0 45 09.1 ^{337.7}	5 27.7 ^{5 27.1}	3.18	.768 638	7 33 24
23	13 34 06.19 ^{79.25}	54.18	0 39 31.4 ^{331.9}	5 26.5 ^{5 26.3}	3.19	.756 926	7 30 47
24	13 35 25.44 ^{78.69}	54.22	0 33 59.5 ^{326.2}		3.21	.745 160	7 28 10
25	13 36 44.13 ^{78.14}	54.25	0 28 33.3 ^{320.3}		3.22	.733 342	7 25 33
26	13 38 02.27 ⁺ 77.57	+0 54.28	+ 0 23 13.0 ^{-314.4}	-5 25.9 ^{5 25.3}	3.23	2.721 474	7 22 54
27	13 39 19.84 ^{76.98}	54.32	0 17 58.6 ^{308.3}	5 24.3 ^{5 23.7}	3.25	.709 556	7 20 15
28	13 40 36.82 ^{76.38}	54.36	0 12 50.3 ^{302.2}	5 23.1 ^{5 22.5}	3.26	.697 590	7 17 36
29	13 41 53.20 ^{75.77}	54.41	0 07 48.1 ^{296.1}	5 21.9 ^{5 21.3}	3.28	.685 579	7 14 56
30	13 43 08.97 ^{75.14}	54.45	+ 0 02 52.0 ^{289.8}		3.29	.673 523	7 12 15
31	13 44 24.11 ⁺ 74.51	+0 54.50	- 0 01 57.8 ^{-283.6}	-5 25.9 ^{5 25.3}	3.31	2.661 425	7 09 34
32*	13 45 38.62	+0 54.55	- 0 06 41.4		3.32	2.649 287	7 06 52

Photographic Magnitude : Nov. 26, 8.5 ; Dec. 16, 8.3 ; Dec. 36, 8.1

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
Jan. 0	^h ^m ^s 0 54 06.78	^m ^s +0 49.98	[°] ['] ["] -19 28 11.5	["] +328.5	["] +5 20.3	2.480 081	^h ^m ^s 18 16 37
1	0 54 50.19	49.96	19 22 43.0	328.5	5 20.1	3.53	490 485
2	0 55 34.72	44.53	19 17 07.4	335.6	5 19.8	3.52	500 854
3	0 56 20.38	45.66	19 11 24.8	342.6	5 19.5	3.50	511 186
4	0 57 07.15	46.77	19 05 35.3	349.5	5 19.1	3.49	521 479
5	0 57 55.02	47.87		356.1			
6	0 58 43.97	+0 49.85	-18 59 39.2	+362.7	+5 18.8	3.48	2.531 730
7	0 59 34.00	49.82	18 53 36.5	369.0	5 18.5	3.46	541 938
8	1 00 25.09	50.03	18 47 27.5	375.2	5 18.2	3.45	552 098
9	1 01 17.23	51.09	18 41 12.3	381.2	5 17.9	3.43	562 210
10*	1 02 10.40	52.14	18 34 51.1	387.0	5 17.6	3.42	572 271
11	1 03 04.60	53.17					
12	1 03 59.81	+0 49.74	-18 28 24.1	+392.7	+5 17.3	3.41	2.582 278
13	1 04 56.01	49.73	18 21 51.4	398.2	5 17.0	3.39	592 229
14	1 05 53.20	55.21	18 15 13.2	403.5	5 16.6	3.38	602 122
15	1 06 51.35	56.20	18 08 29.7	408.7	5 16.3	3.37	611 955
16	1 07 50.46	57.19	18 01 41.0	413.6	5 15.9	3.36	621 726
17	1 08 50.51	58.15					
18	1 09 51.49	+0 49.64	-17 54 47.4	+418.5	+5 15.5	3.34	2.631 433
19	1 10 53.38	49.61	17 47 48.9	423.2	5 15.1	3.33	641 073
20	1 11 56.17	49.58	17 40 45.7	427.7	5 14.6	3.32	650 646
21	1 12 59.85	49.55	17 33 38.0	432.1	5 14.2	3.31	660 150
22	1 14 04.40	49.52	17 26 25.9	436.3	5 13.7	3.30	669 583
23	1 15 09.82	+0 49.50	-17 19 09.6	+440.5	+5 13.2	3.28	2.678 944
24*	1 16 16.08	49.48	17 11 49.1	444.3	5 12.8	3.27	688 231
25	1 17 23.18	63.68	17 04 24.8	448.2	5 12.3	3.26	697 444
26	1 18 31.11	64.55	16 56 56.6	451.8	5 11.9	3.25	706 580
27	1 19 39.86	65.42	16 49 24.8	455.5	5 11.4	3.24	715 640
28	1 20 49.41	66.26					
29	1 21 59.76	67.10	-16 41 49.3	+458.8	+5 11.0	3.23	2.724 622
30	1 23 10.89	67.93	16 34 10.5	462.2	5 10.5	3.22	733 525
31	1 24 22.81	68.75	16 26 28.3	465.5	5 10.0	3.21	742 348
Feb. 1	1 25 35.50	69.55	16 18 42.8	468.6	5 09.5	3.20	751 091
2	1 26 48.95	70.35	16 10 54.2	471.6	5 08.9	3.19	759 753
3	1 28 03.16	71.13					
4	1 29 18.12	+0 49.32	-16 03 02.6	+474.5	+5 08.3	3.18	2.768 333
5	1 30 33.82	49.30	15 55 08.1	477.4	5 07.7	3.17	776 830
6	1 31 50.25	49.27	15 47 10.7	480.1	5 07.1	3.16	785 244
7*	1 33 07.41	49.25	15 39 10.6	482.7	5 06.5	3.15	793 572
8	1 34 25.28	49.24	15 31 07.9	485.3	5 05.8	3.14	801 815
9	1 35 43.86	+0 49.22	-15 23 02.6	+487.6	+5 05.2	3.13	2.809 970
10	1 37 03.14	49.21	15 14 55.0	490.0	5 04.6	3.12	818 038
11	1 38 23.11	49.20	15 06 45.0	492.1	5 04.0	3.11	826 016
12	1 39 43.77	49.19	14 58 32.9	494.3	5 03.3	3.11	833 904
13	1 41 05.09	49.18	14 50 18.6	496.2	5 02.7	3.10	841 701
14	1 42 27.08	+0 49.17	-14 42 02.4	+498.0	+5 02.0	3.09	2.849 406
15	1 43 49.72	49.16	14 33 44.4	499.8	5 01.3	3.08	857 018
		49.14	14 25 24.6	501.4	5 00.5	3.07	864 535
		49.12	14 17 03.2	502.9	4 59.7	3.06	871 958
		49.10	14 08 40.3	504.3	4 58.9	3.06	879 286
		+0 49.09	-14 00 16.0	+505.6	+4 58.1	3.05	2.886 518
		+0 49.07	-13 51 50.4		+4 57.3	3.04	2.893 653

Photographic Magnitude : Jan. 10, 9.2 ; Jan. 30, 9.3

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

PALLAS, 1967

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	h m s	m s	° ' "	' "	"		h m s
Feb. 15	1 43 49.72 ^s	+0 49.07	-13 51 50.4	+4 57.3	3.04	2.893 653	16 05 41
16	1 45 13.02 ^{83.30}	49.06	13 43 23.6	4 56.4	3.03	.900 692	16 03 09
17	1 46 36.95 ^{83.93}	49.04	13 34 55.8	4 55.5	3.03	.907 633	16 00 37
18	1 48 01.51 ^{84.56}	49.04	13 26 26.9	4 54.7	3.02	.914 477	15 58 05
19	1 49 26.69 ^{85.18}	49.03	13 17 57.2	4 53.8	3.01	.921 224	15 55 35
	^{85.80}		^{510.6}				
20	1 50 52.49 ^{86.40}	+0 49.03	-13 09 26.6	+4 52.9	3.01	2.927 872	15 53 05
21	1 52 18.89 ^{87.01}	49.03	13 00 55.4	4 52.1	3.00	.934 423	15 50 35
22*	1 53 45.90 ^{87.60}	49.03	12 52 23.5	4 51.2	2.99	.940 877	15 48 06
23	1 55 13.50 ^{88.18}	49.03	12 43 51.2	4 50.3	2.99	.947 232	15 45 38
24	1 56 41.68 ^{88.77}	49.02	12 35 18.3	4 49.4	2.98	.953 491	15 43 10
			^{513.2}				
25	1 58 10.45 ^{89.34}	+0 49.01	-12 26 45.1	+4 48.4	2.97	2.959 652	15 40 43
26	1 59 39.79 ^{89.91}	49.01	12 18 11.6	4 47.4	2.97	.965 716	15 38 16
27	2 01 09.70 ^{90.49}	49.00	12 09 37.8	4 46.4	2.96	.971 684	15 35 50
28	2 02 40.19 ^{91.04}	48.99	12 01 03.9	4 45.3	2.96	.977 555	15 33 25
Mar. 1	2 04 11.23 ^{91.61}	48.98	11 52 29.8	4 44.2	2.95	.983 329	15 31 00
			^{514.0}				
2	2 05 42.84 ^{92.17}	+0 48.98	-11 43 55.8	+4 43.1	2.94	2.989 006	15 28 36
3	2 07 15.01 ^{92.71}	48.98	11 35 21.8	4 42.0	2.94	2.994 585	15 26 12
4	2 08 47.72 ^{93.27}	48.98	11 26 47.9	4 40.9	2.93	3.000 068	15 23 49
5	2 10 20.99 ^{93.81}	48.99	11 18 14.3	4 39.8	2.93	.005 453	15 21 26
6	2 11 54.80 ^{94.36}	49.00	11 09 41.0	4 38.7	2.92	.010 740	15 19 04
			^{512.9}				
7*	2 13 29.16 ^{94.89}	+0 49.00	-11 01 08.1	+4 37.6	2.92	3.015 929	15 16 42
8	2 15 04.05 ^{95.42}	49.01	10 52 35.7	4 36.4	2.91	.021 019	15 14 21
9	2 16 39.47 ^{95.94}	49.01	10 44 03.8	4 35.2	2.91	.026 012	15 12 00
10	2 18 15.41 ^{96.47}	49.01	10 35 32.7	4 34.0	2.90	.030 906	15 09 40
11	2 19 51.88 ^{96.98}	49.01	10 27 02.3	4 32.7	2.90	.035 701	15 07 21
			^{509.6}				
12	2 21 28.86 ^{97.50}	+0 49.01	-10 18 32.7	+4 31.4	2.89	3.040 398	15 05 02
13	2 23 06.36 ^{98.00}	49.01	10 10 04.2	4 30.1	2.89	.044 997	15 02 43
14	2 24 44.36 ^{98.50}	49.01	10 01 36.6	4 28.8	2.89	.049 497	15 00 25
15	2 26 22.86 ^{98.99}	49.01	9 53 10.2	4 27.4	2.88	.053 900	14 58 08
16	2 28 01.85 ^{99.49}	49.01	9 44 45.1	4 26.0	2.88	.058 204	14 55 51
			^{503.9}				
17	2 29 41.34 ^{99.97}	+0 49.02	-9 36 21.2	+4 24.6	2.87	3.062 412	14 53 34
18	2 31 21.31 ^{100.44}	49.03	9 27 58.7	4 23.2	2.87	.066 522	14 51 18
19	2 33 01.75 ^{100.93}	49.05	9 19 37.7	4 21.8	2.87	.070 536	14 49 03
20	2 34 42.68 ^{101.39}	49.06	9 11 18.2	4 20.4	2.86	.074 453	14 46 47
21	2 36 24.07	+0 49.08	-9 03 00.4	+4 19.0	2.86	3.078 276	14 44 33
Sept. 25	9 03 23.43 ^{118.47}	+0 51.12	-6 38 20.5	-3 57.4	3.26	2.698 718	8 51 01
26	9 05 21.90 ^{118.13}	51.12	6 45 30.0	3 59.6	3.27	.692 248	8 49 03
27	9 07 20.03 ^{117.81}	51.13	6 52 41.3	4 01.8	3.28	.685 718	8 47 04
28	9 09 17.84 ^{117.46}	51.13	6 59 54.3	4 03.9	3.28	.679 127	8 45 06
29	9 11 15.30 ^{117.12}	51.13	7 07 08.8	4 06.0	3.29	.672 474	8 43 07
			^{436.0}				
30	9 13 12.42 ^{116.77}	+0 51.13	-7 14 24.8	-4 08.0	3.30	2.665 761	8 41 07
Oct. 1	9 15 09.19	+0 51.13	-7 21 42.0	-4 10.0	3.31	2.658 984	8 39 08

Photographic Magnitude : Feb. 19, 9.4 ; Mar. 11, 9.4 ; Sept. 27, 8.8

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

PALLAS, 1967

FOR 0^h EPHEMERIS TIME

243

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]			^h ^m ^s
Oct. 1	9 15 09.19 +116.42	+0 51.13	- 7 21 42.0 -438.5	-4 10.0	3.31	2.658 984	8 39 08
2	9 17 05.61 116.05	51.13	7 29 00.5 439.6	4 12.0	3.32	.652 145	8 37 07
3	9 19 01.66 115.69	51.12	7 36 20.1 440.5	4 13.9	3.33	.645 243	8 35 07
4	9 20 57.35 115.32	51.12	7 43 40.6 441.4	4 15.9	3.34	.638 278	8 33 06
5	9 22 52.67 114.94	51.12	7 51 02.0 442.1	4 17.8	3.34	.631 250	8 31 05
6*	9 24 47.61 +114.55	+0 51.12	- 7 58 24.1 -442.7	-4 19.7	3.35	2.624 158	8 29 03
7	9 26 42.16 114.18	51.13	8 05 46.8 443.1	4 21.7	3.36	.617 002	8 27 01
8	9 28 36.34 113.78	51.14	8 13 09.9 443.4	4 23.6	3.37	.609 783	8 24 59
9	9 30 30.12 113.40	51.15	8 20 33.3 443.6	4 25.5	3.38	.602 501	8 22 56
10	9 32 23.52 112.99	51.17	8 27 56.9 443.7	4 27.4	3.39	.595 156	8 20 53
11	9 34 16.51 +112.60	+0 51.18	- 8 35 20.6 -443.7	-4 29.3	3.40	2.587 748	8 18 50
12	9 36 09.11 112.21	51.19	8 42 44.3 443.5	4 31.0	3.41	.580 277	8 16 46
13	9 38 01.32 111.79	51.20	8 50 07.8 443.3	4 32.8	3.42	.572 742	8 14 42
14	9 39 53.11 111.40	51.21	8 57 31.1 442.9	4 34.5	3.43	.565 143	8 12 37
15	9 41 44.51 110.98	51.22	9 04 54.0 442.4	4 36.2	3.44	.557 481	8 10 32
16	9 43 35.49 +110.57	+0 51.22	- 9 12 16.4 -441.9	-4 37.8	3.45	2.549 754	8 08 26
17	9 45 26.06 110.16	51.23	9 19 38.3 441.1	4 39.5	3.46	.541 964	8 06 20
18	9 47 16.22 109.73	51.24	9 26 59.4 440.4	4 41.1	3.47	.534 108	8 04 14
19	9 49 05.95 109.32	51.25	9 34 19.8 439.5	4 42.8	3.48	.526 188	8 02 07
20	9 50 55.27 108.88	51.26	9 41 39.3 438.4	4 44.4	3.49	.518 202	8 00 00
21*	9 52 44.15 +108.45	+0 51.28	- 9 48 57.7 -437.3	-4 46.0	3.51	2.510 151	7 57 52
22	9 54 32.60 108.02	51.30	9 56 15.0 436.0	4 47.6	3.52	.502 034	7 55 44
23	9 56 20.62 107.57	51.32	10 03 31.0 434.7	4 49.2	3.53	.493 851	7 53 36
24	9 58 08.19 107.12	51.34	10 10 45.7 433.2	4 50.7	3.54	.485 601	7 51 27
25	9 59 55.31 106.66	51.37	10 17 58.9 431.5	4 52.3	3.55	.477 284	7 49 18
26	10 01 41.97 +106.20	+0 51.39	-10 25 10.4 -429.8	-4 53.8	3.56	2.468 901	7 47 08
27	10 03 28.17 105.74	51.42	10 32 20.2 427.9	4 55.2	3.58	.460 449	7 44 57
28	10 05 13.91 105.25	51.44	10 39 28.1 426.0	4 56.6	3.59	.451 931	7 42 47
29	10 06 59.16 104.77	51.46	10 46 34.1 423.7	4 58.0	3.60	.443 344	7 40 35
30	10 08 43.93 104.28	51.48	10 53 37.8 421.4	4 59.4	3.61	.434 690	7 38 24
31	10 10 28.21 +103.77	+0 51.50	-11 00 39.2 -419.0	-5 00.7	3.63	2.425 968	7 36 12
Nov. 1	10 12 11.98 103.27	51.52	11 07 38.2 416.3	5 02.0	3.64	.417 179	7 33 59
2	10 13 55.25 102.75	51.55	11 14 34.5 413.5	5 03.4	3.65	.408 322	7 31 46
3	10 15 38.00 102.22	51.58	11 21 28.0 410.6	5 04.7	3.67	.399 399	7 29 32
4*	10 17 20.22 101.70	51.61	11 28 18.6 407.4	5 06.1	3.68	.390 409	7 27 18
5	10 19 01.92 +101.15	+0 51.65	-11 35 06.0 -404.1	-5 07.4	3.70	2.381 354	7 25 03
6	10 20 43.07 100.61	51.69	11 41 50.1 400.7	5 08.7	3.71	.372 234	7 22 48
7	10 22 23.68 100.06	51.73	11 48 30.8 397.1	5 10.0	3.72	.363 050	7 20 32
8	10 24 03.74 99.50	51.77	11 55 07.9 393.3	5 11.2	3.74	.353 802	7 18 15
9	10 25 43.24 98.95	51.80	12 01 41.2 389.4	5 12.4	3.75	.344 490	7 15 58
10	10 27 22.19 +98.37	+0 51.84	-12 08 10.6 -385.4	-5 13.6	3.77	2.335 116	7 13 41
11	10 29 00.56 97.80	51.87	12 14 36.0 381.2	5 14.7	3.78	.325 679	7 11 23
12	10 30 38.36 97.22	51.90	12 20 57.2 376.9	5 15.8	3.80	.316 181	7 09 04
13	10 32 15.58 96.64	51.93	12 27 14.1 372.4	5 16.8	3.82	.306 621	7 06 45
14	10 33 52.22 96.03	51.97	12 33 26.5 367.7	5 17.9	3.83	.296 999	7 04 25
15	10 35 28.25 +95.44	+0 52.00	-12 39 34.2 -363.0	-5 18.9	3.85	2.287 317	7 02 04
16	10 37 03.69 95.00	+0 52.04	-12 45 37.2	-5 20.0	3.86	2.277 575	6 59 43

Photographic Magnitude : Oct. 17, 8.7 ; Nov. 6, 8.6

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

PALLAS, 1967

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	h m s	m s	° ' "	' "			h m s
Nov. 16	10 37 03.69 ^s	+0 52.04	-12 45 37.2	-5 20.0	3.86	2.277 575	6 59 43
17	10 38 38.52 ⁺ 94.83	52.08	12 51 35.2	5 21.0	3.88	.267 772	6 57 22
18*	10 40 12.72	52.12	12 57 28.2	5 22.1	3.90	.257 910	6 55 00
19	10 41 46.30	52.17	13 03 15.9	5 23.1	3.91	.247 989	6 52 37
20	10 43 19.24	52.22	13 08 58.2	5 24.1	3.93	.238 008	6 50 13
21	10 44 51.53	+0 52.27	-13 14 34.9	-5 25.1	3.95	2.227 970	6 47 49
22	10 46 23.17 ⁺ 91.64	52.32	13 20 05.8	5 26.1	3.97	.217 873	6 45 24
23	10 47 54.13	52.37	13 25 30.9	5 27.0	3.99	.207 718	6 42 59
24	10 49 24.42	52.41	13 30 49.8	5 27.9	4.00	.197 507	6 40 32
25	10 50 54.01	52.46	13 36 02.4	5 28.8	4.02	.187 239	6 38 06
26	10 52 22.89	+0 52.50	-13 41 08.6	-5 29.6	4.04	2.176 916	6 35 38
27	10 53 51.06 ⁺ 88.17	52.54	13 46 08.0	5 30.4	4.06	.166 537	6 33 10
28	10 55 18.49	52.59	13 51 00.5	5 31.2	4.08	.156 105	6 30 41
29	10 56 45.18	52.63	13 55 45.9	5 32.0	4.10	.145 619	6 28 11
30	10 58 11.10	52.68	14 00 24.0	5 32.9	4.12	.135 082	6 25 40
Dec. 1	10 59 36.25	+0 52.74	-14 04 54.4	-5 33.7	4.14	2.124 495	6 23 09
2*	11 01 00.61 ⁺ 84.36	52.80	14 09 17.0	5 34.5	4.16	.113 858	6 20 37
3	11 02 24.16	52.86	14 13 31.5	5 35.3	4.18	.103 174	6 18 04
4	11 03 46.91	52.92	14 17 37.8	5 36.1	4.21	.092 445	6 15 30
5	11 05 08.82	52.98	14 21 35.5	5 36.9	4.23	.081 671	6 12 56
6	11 06 29.90	+0 53.04	-14 25 24.5	-5 37.6	4.25	2.070 855	6 10 21
7	11 07 50.12 ⁺ 80.22	53.09	14 29 04.5	5 38.3	4.27	.059 998	6 07 44
8	11 09 09.48	53.14	14 32 35.3	5 39.0	4.29	.049 102	6 05 07
9	11 10 27.97	53.19	14 35 56.7	5 39.6	4.32	.038 167	6 02 29
10	11 11 45.56	53.24	14 39 08.5	5 40.2	4.34	.027 197	5 59 50
11	11 13 02.25	+0 53.29	-14 42 10.4	-5 40.8	4.36	2.016 192	5 57 11
12	11 14 18.03 ⁺ 75.78	53.34	14 45 02.2	5 41.4	4.39	2.005 154	5 54 30
13	11 15 32.88	53.39	14 47 43.6	5 42.0	4.41	1.994 084	5 51 48
14	11 16 46.79	53.45	14 50 14.5	5 42.6	4.44	.982 984	5 49 06
15	11 17 59.73	53.51	14 52 34.6	5 43.2	4.46	.971 855	5 46 22
16*	11 19 11.70	+0 53.57	-14 54 43.6	-5 43.8	4.49	1.960 700	5 43 38
17	11 20 22.68 ⁺ 70.98	53.63	14 56 41.2	5 44.4	4.51	.949 519	5 40 53
18	11 21 32.66	53.69	14 58 27.4	5 45.0	4.54	.938 315	5 38 06
19	11 22 41.61	53.75	15 00 01.6	5 45.6	4.57	.927 089	5 35 19
20	11 23 49.51	53.81	15 01 23.8	5 46.1	4.59	.915 843	5 32 30
21	11 24 56.36	+0 53.87	-15 02 33.5	-5 46.6	4.62	1.904 578	5 29 41
22	11 26 02.13 ⁺ 65.77	53.93	15 03 30.6	5 47.1	4.65	.893 297	5 26 50
23	11 27 06.80	53.98	15 04 14.7	5 47.6	4.68	.882 002	5 23 58
24	11 28 10.34	54.03	15 04 45.5	5 48.0	4.70	.870 694	5 21 05
25	11 29 12.75	54.08	15 05 02.7	5 48.5	4.73	.859 377	5 18 11
26	11 30 13.99	+0 54.13	-15 05 05.9	-5 48.9	4.76	1.848 052	5 15 16
27	11 31 14.05 ⁺ 60.06	54.19	15 04 54.8	5 49.4	4.79	.836 723	5 12 20
28	11 32 12.90	54.24	15 04 29.1	5 49.8	4.82	.825 391	5 09 22
29	11 33 10.52	54.31	15 03 48.4	5 50.3	4.85	.814 060	5 06 23
30*	11 34 06.90	54.37	15 02 52.4	5 50.8	4.88	.802 733	5 03 23
31	11 35 02.01	+0 54.43	-15 01 40.6	-5 51.3	4.91	1.791 413	5 00 22
32	11 35 55.83 ⁺ 53.82	+0 54.50	-15 00 12.8	-5 51.7	4.94	1.780 103	4 57 20

Photographic Magnitude : Nov. 26, 8.4 ; Dec. 16, 8.2 ; Dec. 36, 7.9

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

JUNO, 1967

FOR 0^h EPHEMERIS TIME

245

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
Jan. 0	^h 8 ^m 40 ^s 32.43 - ^s 34.53	+0 52.89	+ 0 36 54.9 +147.5	-3 33.9	6.54	1.346 051	^h 2 ^m 05 ^s 09
1	8 39 57.90 - 36.05	52.93	0 39 22.4 164.7	3 33.4	6.56	.341 908	2 00 38
2	8 39 21.85 - 37.53	52.96	0 42 07.1 182.0	3 32.8	6.58	.337 961	1 56 06
3	8 38 44.32 - 38.95	53.00	0 45 09.1 199.4	3 32.3	6.60	.334 215	1 51 33
4	8 38 05.37 - 40.33	53.03	0 48 28.5 216.8	3 31.7	6.61	.330 673	1 46 58
5*	8 37 25.04 - 41.65	+0 53.07	+ 0 52 05.3 +234.1	-3 31.1	6.63	1.327 341	1 42 22
6	8 36 43.39 - 42.92	53.11	0 55 59.4 251.5	3 30.5	6.65	.324 222	1 37 45
7	8 36 00.47 - 44.13	53.16	1 00 10.9 268.6	3 29.9	6.66	.321 321	1 33 06
8	8 35 16.34 - 45.26	53.21	1 04 39.5 285.8	3 29.3	6.67	.318 642	1 28 27
9	8 34 31.08 - 46.34	53.26	1 09 25.3 302.7	3 28.6	6.69	.316 189	1 23 46
10	8 33 44.74 - 47.34	+0 53.32	+ 1 14 28.0 +319.4	-3 27.9	6.70	1.313 966	1 19 04
11	8 32 57.40 - 48.27	53.37	1 19 47.4 336.0	3 27.2	6.71	.311 976	1 14 21
12	8 32 09.13 - 49.12	53.42	1 25 23.4 352.3	3 26.4	6.72	.310 223	1 09 37
13	8 31 20.01 - 49.90	53.47	1 31 15.7 368.3	3 25.6	6.72	.308 709	1 04 52
14	8 30 30.11 - 50.60	53.52	1 37 24.0 384.0	3 24.7	6.73	.307 439	1 00 07
15	8 29 39.51 - 51.22	+0 53.57	+ 1 43 48.0 +399.4	-3 23.8	6.74	1.306 414	0 55 21
16	8 28 48.29 - 51.76	53.62	1 50 27.4 414.3	3 23.0	6.74	.305 638	0 50 34
17	8 27 56.53 - 52.21	53.67	1 57 21.7 428.9	3 22.1	6.74	.305 112	0 45 46
18	8 27 04.32 - 52.60	53.72	2 04 30.6 443.1	3 21.2	6.74	.304 839	0 40 59
19*	8 26 11.72 - 52.89	53.77	2 11 53.7 456.9	3 20.3	6.74	.304 821	0 36 10
20	8 25 18.83 - 53.11	+0 53.82	+ 2 19 30.6 +470.1	-3 19.4	6.74	1.305 059	0 31 22
21	8 24 25.72 - 53.25	53.88	2 27 20.7 483.0	3 18.5	6.74	.305 555	0 26 33
22	8 23 32.47 - 53.29	53.94	2 35 23.7 495.2	3 17.6	6.74	.306 310	0 21 45
23	8 22 39.18 - 53.27	54.00	2 43 38.9 507.0	3 16.7	6.73	.307 325	0 16 56
24	8 21 45.91 - 53.16	54.07	2 52 05.9 518.3	3 15.7	6.72	.308 601	0 12 07
25	8 20 52.75 - 52.98	+0 54.14	+ 3 00 44.2 +529.0	-3 14.8	6.72	1.310 140	0 07 18
26	8 19 59.77 - 52.72	54.20	3 09 33.2 539.2	3 13.8	6.71	.311 941	{ 0 02 30 } { 23 57 42 }
27	8 19 07.05 - 52.39	54.27	3 18 32.4 548.9	3 12.8	6.70	.314 005	23 52 54
28	8 18 14.66 - 51.97	54.33	3 27 41.3 558.0	3 11.8	6.69	.316 333	23 48 06
29	8 17 22.69 - 51.49	54.39	3 36 59.3 566.5	3 10.8	6.67	.318 924	23 43 19
30	8 16 31.20 - 50.93	+0 54.44	+ 3 46 25.8 +574.5	-3 09.8	6.66	1.321 780	23 38 33
31	8 15 40.27 - 50.30	54.50	3 56 00.3 581.9	3 08.8	6.64	.324 900	23 33 47
Feb. 1*	8 14 49.97 - 49.59	54.56	4 05 42.2 588.7	3 07.9	6.63	.328 284	23 29 02
2	8 14 00.38 - 48.82	54.62	4 15 30.9 595.0	3 07.0	6.61	.331 933	23 24 17
3	8 13 11.56 - 47.96	54.68	4 25 25.9 600.7	3 06.1	6.59	.335 845	23 19 34
4	8 12 23.60 - 47.04	+0 54.75	+ 4 35 26.6 +605.7	-3 05.2	6.57	1.340 021	23 14 51
5	8 11 36.56 - 46.06	54.82	4 45 32.3 610.2	3 04.4	6.55	.344 459	23 10 09
6	8 10 50.50 - 44.99	54.89	4 55 42.5 614.1	3 03.5	6.52	.349 159	23 05 29
7	8 10 05.51 - 43.88	54.96	5 05 56.6 617.3	3 02.6	6.50	.354 118	23 00 49
8	8 09 21.63 - 42.69	55.03	5 16 13.9 620.0	3 01.7	6.47	.359 336	22 56 11
9	8 08 38.94 - 41.45	+0 55.09	+ 5 26 33.9 +622.1	-3 00.8	6.45	1.364 811	22 51 34
10	8 07 57.49 - 40.14	55.15	5 36 56.0 623.6	3 00.0	6.42	.370 541	22 46 58
11	8 07 17.35 - 38.80	55.21	5 47 19.6 624.4	2 59.1	6.39	.376 523	22 42 23
12	8 06 38.55 - 37.40	55.27	5 57 44.0 624.8	2 58.3	6.36	.382 754	22 37 50
13	8 06 01.15 - 35.94	55.32	6 08 08.8 624.6	2 57.5	6.33	.389 233	22 33 19
14	8 05 25.21 - 34.46	+0 55.38	+ 6 18 33.4 +623.8	-2 56.8	6.30	1.395 956	22 28 49
15*	8 04 50.75 -	+0 55.43	+ 6 28 57.2	-2 56.1	6.27	1.402 921	22 24 20

Photographic Magnitude : Jan. 10, 8.7 ; Jan. 30, 8.7

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

JUNO, 1967

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
Feb. 15*	^h 04 ^m 50.75 ^s - 32.93	^m 55.43	[°] 6 28 57.2 ["] + 622.5	["] - 2 56.1	6.27	1.402 921	^h 22 ^m 24 ^s 20
16	8 04 17.82 - 31.36	55.49	6 30 19.7 + 626.8	2 55.4	6.24	.410 124	22 19 53
17	8 03 40.46 - 29.77	55.55	6 40 40.5 + 618.5	2 54.8	6.21	.417 562	22 15 27
18	8 03 16.60 - 28.13	55.61	6 50 59.0 + 615.8	2 54.2	6.17	.425 232	22 11 03
19	8 02 48.56 - 26.49	55.67	7 10 14.8 + 612.5	2 53.6	6.14	.433 130	22 06 41
20	8 02 22.07 - 24.80	+0 55.73	+ 7 20 27.3 + 609.0	-2 53.1	6.11	1.441 252	22 02 20
21	8 01 57.27 - 23.11	55.79	7 30 36.3 + 605.0	2 52.6	6.07	.449 596	21 58 01
22	8 01 34.16 - 21.40	55.86	7 40 41.3 + 600.5	2 52.1	6.04	.458 157	21 53 44
23	8 01 12.76 - 19.68	55.92	7 50 41.8 + 595.8	2 51.6	6.00	.466 933	21 49 28
24	8 00 53.08 - 17.94	55.97	8 00 37.6 + 590.7	2 51.2	5.96	.475 918	21 45 15
25	8 00 35.14 - 16.19	+0 56.02	+ 8 10 28.3 + 585.2	-2 50.7	5.93	1.485 110	21 41 02
26	8 00 18.95 - 14.45	56.07	8 20 13.5 + 579.6	2 50.3	5.89	.494 506	21 36 52
27	8 00 04.50 - 12.68	56.12	8 29 53.1 + 573.5	2 49.9	5.85	.504 102	21 32 43
28*	7 59 51.82 - 10.92	56.16	8 39 26.6 + 567.3	2 49.7	5.81	.513 895	21 28 37
Mar. 1	7 59 40.90 - 9.15	56.21	8 48 53.9 + 560.7	2 49.4	5.77	.523 882	21 24 31
2	7 59 31.75 - 7.38	+0 56.25	+ 8 58 14.6 + 554.0	-2 49.3	5.74	1.534 058	21 20 28
3	7 59 24.37 - 5.60	56.30	9 07 28.6 + 546.9	2 49.1	5.70	.544 422	21 16 26
4	7 59 18.77 - 3.82	56.36	9 16 35.5 + 539.7	2 49.0	5.66	.554 969	21 12 27
5	7 59 14.95 - 2.05	56.41	9 25 35.2 + 532.2	2 49.0	5.62	.565 695	21 08 28
6	7 59 12.90 - 0.28	56.46	9 34 27.4 + 524.5	2 48.9	5.58	.576 598	21 04 32
7	7 59 12.62 + 1.50	+0 56.50	+ 9 43 11.9 + 516.7	-2 48.8	5.54	1.587 673	21 00 37
8	7 59 14.12 + 3.26	56.55	9 51 48.6 + 508.7	2 48.8	5.50	.598 917	20 56 45
9	7 59 17.38 + 5.01	56.59	10 00 17.3 + 500.4	2 48.8	5.46	.610 326	20 52 54
10	7 59 22.39 + 6.77	56.62	10 08 37.7 + 492.0	2 48.8	5.43	.621 895	20 49 04
11	7 59 29.16 + 8.50	56.66	10 16 49.7 + 483.5	2 48.9	5.39	.633 621	20 45 17
12	7 59 37.66 + 10.23	+0 56.69	+ 10 24 53.2 + 474.8	-2 49.0	5.35	1.645 500	20 41 31
13	7 59 47.89 + 11.95	56.71	10 32 48.0 + 466.1	2 49.2	5.31	.657 528	20 37 46
14*	7 59 59.84 + 13.63	56.74	10 40 34.1 + 457.2	2 49.4	5.27	.669 701	20 34 04
15	8 00 13.47 + 15.32	56.77	10 48 11.3 + 448.2	2 49.7	5.23	.682 014	20 30 23
16	8 00 28.79 + 16.98	56.80	10 55 39.5 + 439.1	2 50.0	5.19	.694 465	20 26 44
17	8 00 45.77 + 18.62	+0 56.83	+ 11 02 58.6 + 430.0	-2 50.3	5.16	1.707 048	20 23 06
18	8 01 04.39 + 20.25	56.86	11 10 08.6 + 422.7	2 50.7	5.12	.719 760	20 19 30
19	8 01 24.64 + 21.85	56.89	11 17 09.3 + 411.5	2 51.2	5.08	.732 598	20 15 56
20	8 01 46.49 + 23.43	56.92	11 24 00.8 + 402.2	2 51.6	5.04	.745 556	20 12 23
21	8 02 09.92 + 24.98	56.96	11 30 43.0 + 392.8	2 52.1	5.00	.758 632	20 08 52
22	8 02 34.90 + 26.52	+0 56.98	+ 11 37 15.8 + 383.5	-2 52.6	4.97	1.771 822	20 05 22
23	8 03 01.42 + 28.02	57.01	11 43 39.3 + 374.1	2 53.0	4.93	.785 123	20 01 54
24	8 03 29.44 + 29.50	57.03	11 49 53.4 + 364.7	2 53.6	4.89	.798 530	19 58 27
25	8 03 58.94 + 30.97	57.05	11 55 58.1 + 355.3	2 54.1	4.86	.812 041	19 55 02
26	8 04 29.91 + 32.40	57.06	12 01 53.4 + 346.0	2 54.7	4.82	.825 653	19 51 38
27	8 05 02.31 + 33.81	+0 57.07	+ 12 07 39.4 + 336.7	-2 55.3	4.78	1.839 363	19 48 15
28*	8 05 36.12 + 35.19	57.08	12 13 16.1 + 327.3	2 56.0	4.75	.853 167	19 44 54
29	8 06 11.31 + 36.57	57.09	12 18 43.4 + 318.0	2 56.7	4.71	.867 064	19 41 34
30	8 06 47.88 + 37.91	57.11	12 24 01.4 + 308.7	2 57.5	4.68	.881 050	19 38 16
31	8 07 25.79 + 39.23	57.13	12 29 10.1 + 299.4	2 58.3	4.64	.895 123	19 34 59
Apr. 1	8 08 05.02 + 40.54	+0 57.15	+ 12 34 09.5 + 290.2	-2 59.2	4.61	1.909 279	19 31 43
2	8 08 45.56 + 42.00	+0 57.16	+ 12 38 59.7 + 281.0	-3 00.0	4.57	1.923 517	19 28 28

Photographic Magnitude : Feb. 19, 9.0 ; Mar. 11, 9.3 ; Mar. 31, 9.7

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

JUNO, 1967
FOR 0^h EPHEMERIS TIME

247

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	<small>h m s</small>	<small>m s</small>	<small>° ' "</small>	<small>' "</small>			<small>h m s</small>
Apr. 1	8 08 05.02 ⁺ _{40.54}	+0 57.15	+12 34 09.5 ⁺ _{290.2}	-2 59.2	4.61	1.909 279	19 31 43
2	8 08 45.56 ⁺ _{41.83}	57.16	12 38 59.7 ⁺ _{280.9}	3 00.0	4.57	.923 517	19 28 28
3	8 09 27.39 _{43.09}	57.18	12 43 40.6 _{271.7}	3 00.8	4.54	.937 832	19 25 15
4	8 10 10.48 _{44.33}	57.19	12 48 12.3 _{262.5}	3 01.7	4.51	.952 223	19 22 03
5	8 10 54.81 _{45.55}	57.20	12 52 34.8 _{253.3}	3 02.5	4.47	.966 686	19 18 52
6	8 11 40.36 ⁺ _{46.76}	+0 57.20	+12 56 48.1 ⁺ _{244.2}	-3 03.4	4.44	1.981 218	19 15 43
7	8 12 27.12 ⁺ _{47.93}	57.20	13 00 52.3 _{235.0}	3 04.3	4.41	1.995 816	19 12 34
8	8 13 15.05 _{49.09}	57.19	13 04 47.3 _{226.0}	3 05.2	4.38	2.010 478	19 09 27
9	8 14 04.14 _{50.23}	57.19	13 08 33.3 _{216.8}	3 06.2	4.35	.025 199	19 06 21
10	8 14 54.37 _{51.34}	57.18	13 12 10.1 _{207.9}	3 07.2	4.31	.039 978	19 03 16
11*	8 15 45.71 ⁺ _{52.43}	+0 57.17	+13 15 38.0 ⁺ _{198.9}	-3 08.2	4.28	2.054 811	19 00 12
12	8 16 38.14 ⁺ _{53.50}	57.17	13 18 56.9 ⁺ _{190.0}	3 09.2	4.25	.069 695	18 57 09
13	8 17 31.64 _{54.54}	57.16	13 22 06.9 _{181.1}	3 10.3	4.22	.084 627	18 54 07
14	8 18 26.18 _{55.57}	57.16	13 25 08.0 _{172.3}	3 11.5	4.19	.099 605	18 51 06
15	8 19 21.75 _{56.58}	57.16	13 28 00.3 _{163.4}	3 12.6	4.16	.114 625	18 48 06
16	8 20 18.33 ⁺ _{57.55}	+0 57.16	+13 30 43.7 ⁺ _{154.8}	-3 13.7	4.13	2.129 685	18 45 08
17	8 21 15.88 ⁺ _{58.50}	57.16	13 33 18.5 _{146.1}	3 14.9	4.10	.144 783	18 42 10
18	8 22 14.38 _{59.44}	57.16	13 35 44.6 _{137.5}	3 16.0	4.07	.159 914	18 39 13
19	8 23 13.82 _{60.34}	57.15	13 38 02.1 _{128.9}	3 17.2	4.05	.175 078	18 36 17
20	8 24 14.16 _{61.23}	57.14	13 40 11.0 _{120.6}	3 18.3	4.02	.190 271	18 33 22
21	8 25 15.39 ⁺ _{62.10}	+0 57.13	+13 42 11.6 ⁺ _{112.1}	-3 19.5	3.99	2.205 492	18 30 27
22	8 26 17.49 ⁺ _{62.93}	57.11	13 44 03.7 _{103.8}	3 20.6	3.96	.220 737	18 27 34
23	8 27 20.42 _{63.76}	57.09	13 45 47.5 _{95.5}	3 21.8	3.94	.236 006	18 24 41
24*	8 28 24.18 _{64.56}	57.07	13 47 23.0 _{87.4}	3 23.1	3.91	.251 295	18 21 49
25	8 29 28.74 _{65.35}	57.05	13 48 50.4 _{79.4}	3 24.4	3.88	.266 605	18 18 58
26	8 30 34.09 ⁺ _{66.11}	+0 57.03	+13 50 09.8 ⁺ _{71.2}	-3 25.7	3.86	2.281 931	18 16 08
27	8 31 40.20 _{66.85}	57.02	13 51 21.0 _{63.3}	3 27.0	3.83	.297 274	18 13 18
28	8 32 47.05 _{67.60}	57.01	13 52 24.3 _{55.5}	3 28.3	3.81	.312 631	18 10 29
29	8 33 54.65 _{68.30}	57.00	13 53 19.8 _{47.5}	3 29.7	3.78	.328 001	18 07 41
30	8 35 02.95 _{69.02}	56.99	13 54 07.3 _{39.8}	3 31.0	3.76	.343 381	18 04 54
May 1	8 36 11.97 ⁺ _{69.69}	+0 56.97	+13 54 47.1 ⁺ _{32.0}	-3 32.3	3.73	2.358 769	18 02 07
2	8 37 21.66 ⁺ _{70.38}	56.95	13 55 19.1 _{24.4}	3 33.6	3.71	.374 164	17 59 21
3	8 38 32.04 _{71.02}	56.93	13 55 43.5 _{16.8}	3 34.9	3.68	.389 563	17 56 36
4	8 39 43.06 _{71.67}	56.90	13 56 00.3 _{9.2}	3 36.2	3.66	.404 965	17 53 51
5	8 40 54.73 _{72.30}	56.87	13 56 09.5 _{1.6}	3 37.5	3.64	.420 367	17 51 07
6	8 42 07.03 ⁺ _{72.90}	+0 56.84	+13 56 11.1 ⁺ _{5.7}	-3 38.8	3.61	2.435 767	17 48 23
7	8 43 19.93 _{73.51}	56.80	13 56 05.4 _{13.1}	3 40.1	3.59	.451 163	17 45 40
8	8 44 33.44 _{74.08}	56.77	13 55 52.3 _{20.5}	3 41.5	3.57	.466 553	17 42 58
9*	8 45 47.52 _{74.65}	56.74	13 55 31.8 _{27.8}	3 42.9	3.55	.481 934	17 40 16
10	8 47 02.17 _{75.20}	56.71	13 55 04.0 _{34.9}	3 44.3	3.52	.497 306	17 37 35
11	8 48 17.37 ⁺ _{75.74}	+0 56.68	+13 54 29.1 ⁺ _{42.1}	-3 45.7	3.50	2.512 665	17 34 54
12	8 49 33.11 _{76.27}	56.66	13 53 47.0 _{49.1}	3 47.1	3.48	.528 009	17 32 14
13	8 50 49.38 _{76.76}	56.63	13 52 57.9 _{56.2}	3 48.5	3.46	.543 337	17 29 35
14	8 52 06.14 _{77.26}	56.61	13 52 01.7 _{63.0}	3 49.9	3.44	.558 647	17 26 55
15	8 53 23.40 _{77.74}	56.58	13 50 58.7 _{70.0}	3 51.3	3.42	.573 935	17 24 17
16	8 54 41.14 ⁺ _{78.20}	+0 56.56	+13 49 48.7 ⁺ _{76.7}	-3 52.7	3.40	2.589 202	17 21 38
17	8 55 59.34 _{78.74}	+0 56.53	+13 48 32.0 _{76.7}	-3 54.0	3.38	2.604 444	17 19 01

Photographic Magnitude : Apr. 20, 10.0 ; May 10, 10.4

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

JUNO, 1967

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit	
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.				
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]	["]		^h ^m ^s	
May 17	8 55 59.34 + 78.64	+0 56.53	+13 48 32.0	- 83.5	-3 54.0	3.38	2.604 444	17 19 01
18	8 57 17.98 79.08	56.49	13 47 08.5	90.1	3 55.4	3.36	.619 661	17 16 23
19	8 58 37.06 79.49	56.45	13 45 38.4	96.6	3 56.7	3.34	.634 850	17 13 46
20	8 59 56.55 79.90	56.41	13 44 01.8	103.2	3 58.1	3.32	.650 010	17 11 10
21	9 01 16.45 80.29	56.37	13 42 18.6	109.5	3 59.5	3.30	.665 140	17 08 34
22*	9 02 36.74 + 80.67	+0 56.33	+13 40 29.1	-115.9	-4 00.9	3.28	2.680 239	17 05 58
23	9 03 57.41 81.04	56.30	13 38 33.2	122.1	4 02.3	3.26	.695 305	17 03 23
24	9 05 18.45 81.40	56.26	13 36 31.1	128.4	4 03.8	3.25	.710 337	17 00 48
25	9 06 39.85 81.74	56.23	13 34 22.7	134.5	4 05.2	3.23	.725 334	16 58 13
26	9 08 01.59 82.09	56.20	13 32 08.2	140.5	4 06.7	3.21	.740 296	16 55 39
27	9 09 23.68 + 82.42	+0 56.18	+13 29 47.7	-146.6	-4 08.1	3.19	2.755 220	16 53 05
28	9 10 46.10 82.74	56.14	13 27 21.1	152.5	4 09.5	3.18	.770 106	16 50 31
29	9 12 08.84 83.05	56.11	13 24 48.6	158.4	4 10.8	3.16	.784 952	16 47 58
30	9 13 31.89 83.36	56.07	13 22 10.2	164.3	4 12.2	3.14	.799 756	16 45 24
31	9 14 55.25 83.66	56.03	13 19 25.9	170.1	4 13.5	3.13	.814 518	16 42 52
June 1	9 16 18.91 + 83.94	+0 55.98	+13 16 35.8	-175.8	-4 14.8	3.11	2.829 235	16 40 19
2	9 17 42.85 84.23	55.94	13 13 40.0	181.5	4 16.2	3.09	.843 906	16 37 47
3	9 19 07.08 84.50	55.89	13 10 38.5	187.1	4 17.5	3.08	.858 530	16 35 15
4	9 20 31.58 84.77	55.84	13 07 31.4	192.7	4 18.8	3.06	.873 104	16 32 44
5	9 21 56.35 85.02	55.80	13 04 18.7	198.2	4 20.2	3.05	.887 627	16 30 12
6*	9 23 21.37 + 85.26	+0 55.76	+13 01 00.5	-203.6	-4 21.6	3.03	2.902 098	16 27 41
7	9 24 46.63 85.51	55.72	12 57 36.9	209.0	4 22.9	3.02	.916 515	16 25 10
8	9 26 12.14 85.74	55.68	12 54 07.9	214.3	4 24.3	3.00	.930 876	16 22 39
9	9 27 37.88 85.96	55.64	12 50 33.6	219.6	4 25.7	2.99	.945 179	16 20 09
10	9 29 03.84 86.18	55.61	12 46 54.0	224.8	4 27.0	2.97	.959 424	16 17 39
11	9 30 30.02 + 86.38	+0 55.57	+12 43 09.2	-229.9	-4 28.4	2.96	2.973 608	16 15 09
12	9 31 56.40 86.57	55.54	12 39 19.3	234.9	4 29.7	2.95	2.987 729	16 12 39
13	9 33 22.97 86.77	55.50	12 35 24.4	240.0	4 30.9	2.93	3.001 787	16 10 09
14	9 34 49.74 86.94	55.45	12 31 24.4	244.8	4 32.2	2.92	.015 781	16 07 40
15	9 36 16.68 87.11	55.41	12 27 19.6	249.8	4 33.4	2.90	.029 707	16 05 11
16	9 37 43.79 + 87.28	+0 55.36	+12 23 09.8	-254.4	-4 34.7	2.89	3.043 567	16 02 41
17	9 39 11.07 87.43	55.31	12 18 55.4	259.2	4 35.9	2.88	.057 358	16 00 12
18	9 40 38.50 87.58	55.26	12 14 36.2	263.8	4 37.2	2.87	.071 080	15 57 44
19	9 42 06.08 87.72	55.22	12 10 12.4	268.4	4 38.5	2.85	.084 731	15 55 15
20*	9 43 33.80 87.85	55.18	12 05 44.0	272.9	4 39.8	2.84	.098 311	15 52 46
21	9 45 01.65 + 87.99	+0 55.14	+12 01 11.1	-277.3	-4 41.0	2.83	3.111 819	15 50 18
22	9 46 29.64 88.11	55.11	11 56 33.8	281.7	4 42.3	2.82	.125 254	15 47 50
23	9 47 57.75 88.23	55.07	11 51 52.1	286.0	4 43.6	2.80	.138 616	15 45 22
24	9 49 25.98 88.35	55.04	11 47 06.1	290.3	4 44.8	2.79	.151 903	15 42 54
25	9 50 54.33 88.47	55.00	11 42 15.8	294.5	4 46.0	2.78	.165 115	15 40 26
26	9 52 22.80 + 88.57	+0 54.96	+11 37 21.3	-298.7	-4 47.2	2.77	3.178 250	15 37 58
27	9 53 51.37 88.68	54.91	11 32 22.6	302.8	4 48.3	2.76	.191 308	15 35 30
28	9 55 20.05 88.78	54.87	11 27 19.8	306.9	4 49.5	2.75	.204 287	15 33 02
29	9 56 48.83 88.88	54.82	11 22 12.9	310.9	4 50.6	2.74	.217 186	15 30 35
30	9 58 17.71 88.97	54.77	11 17 02.0	314.9	4 51.7	2.72	.230 003	15 28 08
July 1	9 59 46.68 + 89.07	+0 54.72	+11 11 47.1	-318.7	-4 52.8	2.71	3.242 738	15 25 40
2	10 01 15.75 89.17	+0 54.68	+11 06 28.4	322.9	-4 53.9	2.70	3.255 388	15 23 13

Photographic Magnitude : May 30, 10.7 ; June 19, 10.9

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
July 1	^{h m s} 9 59 46.68 + ^s 89.07	^{m s} +0 54.72	^{° ' "} +11 11 47.1 - ["] 318.7	^{° ' "} -4 52.8	2.71	3.242 738	^{h m s} 15 25 40
2	10 01 15.75 + ^s 89.15	54.68	11 06 28.4 - ["] 322.7	4 53.9	2.70	.255 388	15 23 13
3	10 02 44.90 + ^s 89.23	54.63	11 01 05.7 - ["] 326.4	4 55.1	2.69	.267 954	15 20 46
4*	10 04 14.13 + ^s 89.31	54.59	10 55 39.3 - ["] 330.2	4 56.2	2.68	.280 433	15 18 19
5	10 05 43.44 + ^s 89.39	54.55	10 50 09.1 - ["] 333.8	4 57.3	2.67	.292 823	15 15 52
6	10 07 12.83 + ^s 89.45	+0 54.52	+10 44 35.3 - ["] 337.5	-4 58.5	2.66	3.305 125	15 13 25
7	10 08 42.28 + ^s 89.52	54.48	10 38 57.8 - ["] 341.1	4 59.6	2.65	.317 335	15 10 58
8	10 10 11.80 + ^s 89.58	54.45	10 33 16.7 - ["] 344.6	5 00.7	2.64	.329 453	15 08 31
9	10 11 41.38 + ^s 89.64	54.41	10 27 32.1 - ["] 348.0	5 01.7	2.63	.341 478	15 06 05
10	10 13 11.02 + ^s 89.69	54.38	10 21 44.1 - ["] 351.4	5 02.8	2.62	.353 408	15 03 38
11	10 14 40.71 + ^s 89.73	+0 54.34	+10 15 52.7 - ["] 354.8	-5 03.8	2.61	3.365 242	15 01 11
12	10 16 10.44 + ^s 89.78	54.29	10 09 57.9 - ["] 358.0	5 04.7	2.61	.376 978	14 58 45
13	10 17 40.22 + ^s 89.81	54.25	10 03 59.9 - ["] 361.1	5 05.7	2.60	.388 617	14 56 18
14	10 19 10.03 + ^s 89.84	54.20	9 57 58.8 - ["] 364.3	5 06.7	2.59	.400 156	14 53 52
15	10 20 39.87 + ^s 89.87	54.16	9 51 54.5 - ["] 367.4	5 07.6	2.58	.411 595	14 51 25
16	10 22 09.74 + ^s 89.90	+0 54.12	+ 9 45 47.1 - ["] 370.3	-5 08.6	2.57	3.422 934	14 48 59
17	10 23 39.64 + ^s 89.92	54.08	9 39 36.8 - ["] 373.3	5 09.6	2.56	.434 172	14 46 32
18*	10 25 09.56 + ^s 89.93	54.05	9 33 23.5 - ["] 376.1	5 10.6	2.55	.445 307	14 44 06
19	10 26 39.49 + ^s 89.95	54.01	9 27 07.4 - ["] 379.0	5 11.6	2.55	.456 340	14 41 39
20	10 28 09.44 + ^s	+0 53.99	+ 9 20 48.4 - ["]	-5 12.5	2.54	3.467 270	14 39 13

Photographic Magnitude : July 9, 11.1 ; July 29, 11.3

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

JUNO, 1967

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	h m s	m s	° ' "	' "			h m s
Nov. 26	13 33 58.09 ⁺	+0 54.36	- 5 30 00.8	-5 23.9	2.35	3.750 277	9 16 54
27	13 35 15.39 ⁺	54.40	5 35 03.0	5 23.3	2.35	.742 802	9 14 15
28	13 36 32.41	54.44	5 40 01.1	5 22.6	2.36	.735 184	9 11 36
29	13 37 49.13	54.48	5 44 55.2	5 21.9	2.36	.727 427	9 08 56
30	13 39 05.55	54.52	5 49 45.2	5 21.3	2.37	.719 529	9 06 16
Dec. 1	13 40 21.66 ⁺	+0 54.57	- 5 54 31.0	-5 20.6	2.37	3.711 494	9 03 36
2	13 41 37.45 ⁺	54.63	5 59 12.6	5 20.0	2.38	.703 320	9 00 56
3	13 42 52.91	54.69	6 03 49.8	5 19.4	2.38	.695 011	8 58 15
4*	13 44 08.05	54.74	6 08 22.7	5 18.8	2.39	.686 568	8 55 34
5	13 45 22.84	54.80	6 12 51.2	5 18.2	2.39	.677 991	8 52 52
6	13 46 37.28 ⁺	+0 54.85	- 6 17 15.2	-5 17.6	2.40	3.669 283	8 50 10
7	13 47 51.37 ⁺	54.90	6 21 34.6	5 16.9	2.40	.660 445	8 47 28
8	13 49 05.10	54.94	6 25 49.6	5 16.3	2.41	.651 478	8 44 45
9	13 50 18.47	54.98	6 29 59.9	5 15.6	2.42	.642 385	8 42 02
10	13 51 31.45	55.03	6 34 05.6	5 14.9	2.42	.633 166	8 39 19
11	13 52 44.06 ⁺	+0 55.07	- 6 38 06.5	-5 14.1	2.43	3.623 823	8 36 35
12	13 53 56.28 ⁺	55.11	6 42 02.8	5 13.4	2.43	.614 358	8 33 51
13	13 55 08.11	55.16	6 45 54.2	5 12.7	2.44	.604 771	8 31 07
14	13 56 19.53	55.21	6 49 40.8	5 12.0	2.45	.595 065	8 28 22
15	13 57 30.54	55.26	6 53 22.6	5 11.3	2.45	.585 240	8 25 36
16	13 58 41.14 ⁺	+0 55.31	- 6 56 59.5	-5 10.6	2.46	3.575 298	8 22 51
17	13 59 51.32 ⁺	55.36	7 00 31.3	5 09.9	2.47	.565 240	8 20 04
18	14 01 01.07	55.42	7 03 58.2	5 09.2	2.48	.555 067	8 17 18
19*	14 02 10.37	55.47	7 07 20.0	5 08.5	2.48	.544 782	8 14 31
20	14 03 19.23	55.53	7 10 36.8	5 07.9	2.49	.534 384	8 11 43
21	14 04 27.64 ⁺	+0 55.58	- 7 13 48.3	-5 07.2	2.50	3.523 876	8 08 55
22	14 05 35.57 ⁺	55.62	7 16 54.7	5 06.5	2.50	.513 258	8 06 07
23	14 06 43.04	55.67	7 19 55.8	5 05.8	2.51	.502 533	8 03 18
24	14 07 50.02	55.71	7 22 51.6	5 05.1	2.52	.491 701	8 00 29
25	14 08 56.51	55.76	7 25 42.0	5 04.3	2.53	.480 764	7 57 39
26	14 10 02.49 ⁺	+0 55.80	- 7 28 27.0	-5 03.6	2.54	3.469 724	7 54 49
27	14 11 07.96 ⁺	55.85	7 31 06.5	5 02.8	2.54	.458 582	7 51 58
28	14 12 12.90	55.90	7 33 40.4	5 02.1	2.55	.447 340	7 49 06
29	14 13 17.30	55.95	7 36 08.8	5 01.4	2.56	.436 000	7 46 14
30	14 14 21.15	56.01	7 38 31.4	5 00.7	2.57	.424 564	7 43 22
31	14 15 24.44 ⁺	+0 56.06	- 7 40 48.4	-5 00.1	2.58	3.413 035	7 40 29
32*	14 16 27.15	+0 56.12	- 7 42 59.5	-4 59.4	2.59	3.401 415	7 37 35

Photographic Magnitude : Nov. 26, 11.6 ; Dec. 16, 11.5 ; Dec. 36, 11.4

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

VESTA, 1967
FOR 0^h EPHEMERIS TIME

251

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]	["]		^h ^m ^s
Jan. 0	14 18 40.61	+0 52.50	7 03 53.5	-4 38.7	3.52	2.499 824	7 42 56
1	14 20 21.16	52.56	7 10 42.3	4 37.5	3.54	.487 991	7 40 40
2	14 22 01.40	52.62	7 17 25.7	4 36.3	3.55	.476 112	7 38 24
3	14 23 41.35	52.68	7 24 03.6	4 35.0	3.57	.464 188	7 36 08
4	14 25 20.99	52.74	7 30 36.1	4 33.8	3.59	.452 220	7 33 51
5	14 27 00.30	+0 52.80	7 37 03.0	-4 32.5	3.61	2.440 209	7 31 34
6	14 28 39.27	52.87	7 43 24.3	4 31.2	3.62	.428 155	7 29 17
7	14 30 17.90	52.94	7 49 39.9	4 29.9	3.64	.416 061	7 26 59
8	14 31 56.16	53.01	7 55 49.7	4 28.6	3.66	.403 927	7 24 41
9	14 33 34.06	53.08	8 01 53.7	4 27.3	3.68	.391 754	7 22 22
10	14 35 11.56	+0 53.15	8 07 51.9	-4 26.1	3.70	2.379 544	7 20 03
11	14 36 48.68	53.23	8 13 44.2	4 24.8	3.72	.367 299	7 17 44
12*	14 38 25.38	53.30	8 19 30.5	4 23.5	3.74	.355 019	7 15 24
13	14 40 01.66	53.36	8 25 10.9	4 22.2	3.76	.342 707	7 13 04
14	14 41 37.52	53.43	8 30 45.3	4 20.9	3.78	.330 364	7 10 44
15	14 43 12.92	+0 53.49	8 36 13.6	-4 19.6	3.80	2.317 991	7 08 23
16	14 44 47.88	53.55	8 41 35.8	4 18.3	3.82	.305 590	7 06 01
17	14 46 22.36	53.61	8 46 51.9	4 16.9	3.84	.293 163	7 03 39
18	14 47 56.37	53.66	8 52 01.9	4 15.5	3.86	.280 710	7 01 17
19	14 49 29.89	53.73	8 57 05.8	4 14.1	3.88	.268 233	6 58 54
20	14 51 02.90	+0 53.79	9 02 03.4	-4 12.7	3.90	2.255 733	6 56 31
21	14 52 35.41	53.85	9 06 54.9	4 11.3	3.92	.243 213	6 54 07
22	14 54 07.38	53.92	9 11 40.1	4 09.9	3.94	.230 673	6 51 42
23	14 55 38.82	53.99	9 16 19.2	4 08.6	3.97	.218 114	6 49 17
24	14 57 09.71	54.06	9 20 51.9	4 07.2	3.99	.205 538	6 46 52
25	14 58 40.04	+0 54.13	9 25 18.4	-4 05.9	4.01	2.192 945	6 44 26
26*	15 00 09.79	54.20	9 29 38.6	4 04.5	4.04	.180 338	6 41 59
27	15 01 38.95	54.26	9 33 52.5	4 03.2	4.06	.167 716	6 39 32
28	15 03 07.51	54.32	9 38 00.1	4 01.9	4.08	.155 081	6 37 04
29	15 04 35.45	54.38	9 42 01.3	4 00.5	4.11	.142 434	6 34 36
30	15 06 02.76	+0 54.44	9 45 56.1	-3 59.1	4.13	2.129 777	6 32 07
31	15 07 29.41	54.49	9 49 44.5	3 57.7	4.16	.117 109	6 29 37
Feb. 1	15 08 55.39	54.54	9 53 26.5	3 56.3	4.18	.104 432	6 27 06
2	15 10 20.68	54.60	9 57 01.9	3 54.9	4.21	.091 748	6 24 35
3	15 11 45.26	54.66	10 00 30.9	3 53.5	4.23	.079 058	6 22 03
4	15 13 09.12	+0 54.72	10 03 53.3	-3 52.1	4.26	2.066 364	6 19 31
5	15 14 32.22	54.79	10 07 09.2	3 50.7	4.29	.053 667	6 16 57
6	15 15 54.56	54.85	10 10 18.4	3 49.4	4.31	.040 969	6 14 23
7	15 17 16.11	54.92	10 13 21.1	3 48.1	4.34	.028 272	6 11 48
8	15 18 36.85	54.98	10 16 17.2	3 46.7	4.37	.015 577	6 09 13
9*	15 19 56.76	+0 55.03	10 19 06.7	-3 45.4	4.39	2.002 888	6 06 36
10	15 21 15.83	55.08	10 21 49.6	3 44.1	4.42	.990 205	6 03 59
11	15 22 34.02	55.13	10 24 25.8	3 42.8	4.45	.977 531	6 01 21
12	15 23 51.34	55.18	10 26 55.5	3 41.5	4.48	.964 867	5 58 42
13	15 25 07.75	55.23	10 29 18.7	3 40.1	4.51	.952 216	5 56 01
14	15 26 23.23	+0 55.27	10 31 35.2	-3 38.8	4.54	1.939 580	5 53 21
15	15 27 37.77	+0 55.32	10 33 45.3	3 37.5	4.57	1.926 960	5 50 39

Photographic Magnitude : Jan. 10, 7.9 ; Jan. 30, 7.6

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

VESTA, 1967

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	[°] ['] ["]			^h ^m ^s
Feb. 15	15 27 37.77 ⁺	+0 55.32	-10 33 45.3	-3 37.5	4.57	1.926 960	5 50 39
16	15 28 51.35 ⁺	55.37	10 35 48.7 ^{-123.4}	3 36.1	4.60	.914 358	5 47 56
17	15 30 03.94 ^{72.59}	55.41	10 37 45.7 ^{117.0}	3 34.8	4.63	.901 777	5 45 12
18	15 31 15.54 ^{71.60}	55.46	10 39 36.3 ^{110.6}	3 33.5	4.66	.889 218	5 42 27
19	15 32 26.11 ^{70.57}	55.52	10 41 20.4 ^{104.1}	3 32.3	4.69	.876 683	5 39 41
	69.53		97.6				
20	15 33 35.64 ⁺	+0 55.57	-10 42 58.0	-3 31.0	4.72	1.864 175	5 36 54
21	15 34 44.12 ^{68.48}	55.62	10 44 29.3 ^{-91.3}	3 29.8	4.75	.851 694	5 34 06
22	15 35 51.51 ^{67.39}	55.68	10 45 54.2 ^{84.9}	3 28.7	4.78	.839 242	5 31 17
23*	15 36 57.81 ^{66.30}	55.73	10 47 12.8 ^{78.6}	3 27.5	4.82	.826 822	5 28 27
24	15 38 02.98 ^{65.17}	55.77	10 48 25.1 ^{72.3}	3 26.4	4.85	.814 434	5 25 36
	64.03		66.0				
25	15 39 07.01 ⁺	+0 55.81	-10 49 31.1	-3 25.3	4.88	1.802 081	5 22 44
26	15 40 09.88 ^{62.87}	55.85	10 50 30.9 ^{-59.8}	3 24.1	4.92	.789 764	5 19 50
27	15 41 11.55 ^{61.67}	55.88	10 51 24.4 ^{53.5}	3 23.0	4.95	.777 485	5 16 55
28	15 42 12.01 ^{60.46}	55.92	10 52 11.7 ^{47.3}	3 21.8	4.99	.765 245	5 13 59
Mar. 1	15 43 11.23 ^{59.22}	55.95	10 52 52.8 ^{41.1}	3 20.7	5.02	.753 046	5 11 02
	57.95		34.9				
2	15 44 09.18 ⁺	+0 55.99	-10 53 27.7	-3 19.6	5.05	1.740 891	5 08 04
3	15 45 05.84 ^{56.66}	56.04	10 53 56.5 ^{-28.8}	3 18.5	5.09	.728 781	5 05 04
4	15 46 01.17 ^{55.33}	56.08	10 54 19.1 ^{22.6}	3 17.5	5.13	.716 719	5 02 03
5	15 46 55.15 ^{53.98}	56.12	10 54 35.6 ^{16.5}	3 16.5	5.16	.704 707	4 59 00
6	15 47 47.76 ^{52.61}	56.17	10 54 46.1 ^{10.5}	3 15.5	5.20	.692 748	4 55 57
	51.20		4.5				
7	15 48 38.96 ⁺	+0 56.21	-10 54 50.6	-3 14.6	5.24	1.680 845	4 52 51
8	15 49 28.73 ^{49.77}	56.24	10 54 49.2 ^{+1.4}	3 13.7	5.27	.668 999	4 49 45
9*	15 50 17.04 ^{48.31}	56.27	10 54 41.8 ^{7.4}	3 12.8	5.31	.657 215	4 46 37
10	15 51 03.88 ^{46.84}	56.30	10 54 28.7 ^{13.1}	3 12.0	5.35	.645 494	4 43 27
11	15 51 49.21 ^{45.33}	56.33	10 54 09.8 ^{18.9}	3 11.1	5.39	.633 839	4 40 16
	43.80		24.6				
12	15 52 33.01 ⁺	+0 56.35	-10 53 45.2	-3 10.3	5.42	1.622 254	4 37 03
13	15 53 15.25 ^{42.24}	56.38	10 53 15.1 ^{+30.1}	3 09.4	5.46	.610 740	4 33 49
14	15 53 55.91 ^{40.66}	56.40	10 52 39.4 ^{35.7}	3 08.6	5.50	.599 301	4 30 33
15	15 54 34.98 ^{39.07}	56.42	10 51 58.3 ^{41.1}	3 07.9	5.54	.587 940	4 27 16
16	15 55 12.42 ^{37.44}	56.45	10 51 12.0 ^{46.3}	3 07.1	5.58	.576 660	4 23 57
	35.80		51.6				
17	15 55 48.22 ⁺	+0 56.48	-10 50 20.4	-3 06.4	5.62	1.565 462	4 20 37
18	15 56 22.35 ^{34.13}	56.50	10 49 23.6 ^{+56.8}	3 05.7	5.66	.554 351	4 17 14
19	15 56 54.79 ^{32.44}	56.53	10 48 21.9 ^{61.7}	3 05.1	5.70	.543 329	4 13 51
20	15 57 25.53 ^{30.74}	56.57	10 47 15.3 ^{66.6}	3 04.5	5.74	.532 398	4 10 25
21	15 57 54.54 ^{29.01}	56.60	10 46 03.9 ^{71.4}	3 04.0	5.78	.521 562	4 06 58
	27.27		76.2				
22	15 58 21.81 ⁺	+0 56.62	-10 44 47.7	-3 03.6	5.82	1.510 823	4 03 29
23*	15 58 47.31 ^{25.50}	56.65	10 43 27.1 ^{+80.6}	3 03.1	5.87	.500 184	3 59 58
24	15 59 11.03 ^{23.72}	56.67	10 42 01.9 ^{85.2}	3 02.7	5.91	.489 647	3 56 25
25	15 59 32.94 ^{21.91}	56.68	10 40 32.4 ^{89.5}	3 02.3	5.95	.479 215	3 52 51
26	15 59 53.03 ^{20.09}	56.69	10 38 58.6 ^{93.8}	3 02.0	5.99	.468 890	3 49 15
	18.25		97.9				
27	16 00 11.28 ⁺	+0 56.71	-10 37 20.7	-3 01.6	6.03	1.458 676	3 45 37
28	16 00 27.66 ^{16.38}	56.72	10 35 38.7 ^{+102.0}	3 01.3	6.07	.448 574	3 41 57
29	16 00 42.16 ^{14.50}	56.74	10 33 52.8 ^{105.9}	3 00.9	6.12	.438 589	3 38 15
30	16 00 54.75 ^{12.59}	56.76	10 32 03.0 ^{109.8}	3 00.7	6.16	.428 722	3 34 31
31	16 01 05.42 ^{10.67}	56.78	10 30 09.5 ^{113.5}	3 00.5	6.20	.418 977	3 30 46
	8.73		117.0				
Apr. 1	16 01 14.15 ⁺	+0 56.80	-10 28 12.5	-3 00.4	6.24	1.409 358	3 26 58
2	16 01 20.92 ^{6.77}	+0 56.82	-10 26 12.0 ^{+120.5}	-3 00.3	6.29	1.399 868	3 23 09

Photographic Magnitude : Feb. 19, 7.3 ; Mar. 11, 7.0 ; Mar. 31, 6.7

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

VESTA, 1967
FOR 0^h EPHEMERIS TIME

253

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]			^h ^m ^s
Apr. 1	16 01 14.15 ^s	+0 56.80	-10 28 12.5 ⁺	-3 00.4	6.24	1.409 358	3 26 58
2	16 01 20.92 ⁺ 6.77	56.82	10 26 12.0 ^{+120.5}	3 00.3	6.29	.399 868	3 23 09
3	16 01 25.71 4.79	56.84	10 24 08.3 ^{123.7}	3 00.3	6.33	.390 511	3 19 17
4	16 01 28.52 ⁺ 2.81	56.86	10 22 01.4 ^{126.9}	3 00.3	6.37	.381 289	3 15 24
5*	16 01 29.33 ⁺ 0.81	56.87	10 19 51.5 ^{129.9}	3 00.3	6.41	.372 208	3 11 29
6	16 01 28.13 ⁻ 1.20	+0 56.88	-10 17 38.9 ^{132.6}	-3 00.4	6.46	1.363 270	3 07 31
7	16 01 24.93 ⁻ 3.20	56.88	10 15 23.6 ^{+135.3}	3 00.5	6.50	.354 479	3 03 32
8	16 01 19.71 5.22	56.89	10 13 06.0 ^{137.6}	3 00.7	6.54	.345 839	2 59 31
9	16 01 12.47 7.24	56.89	10 10 46.1 ^{139.9}	3 00.8	6.58	.337 354	2 55 27
10	16 01 03.22 9.25	56.89	10 08 24.3 ^{141.8}	3 01.0	6.62	.329 027	2 51 22
11	16 00 51.96 ⁻ 11.26	+0 56.89	-10 06 00.6 ^{143.7}	-3 01.3	6.66	1.320 862	2 47 15
12	16 00 38.70 ⁻ 13.26	56.90	10 03 35.4 ^{+145.2}	3 01.5	6.70	.312 862	2 43 05
13	16 00 23.44 15.26	56.91	10 01 08.8 ^{146.6}	3 01.8	6.74	.305 032	2 38 54
14	16 00 06.20 17.24	56.92	9 58 41.2 ^{147.6}	3 02.2	6.78	.297 374	2 34 41
15	15 59 47.00 19.20	56.93	9 56 12.6 ^{148.6}	3 02.6	6.82	.289 892	2 30 26
16	15 59 25.84 ⁻ 21.16	+0 56.94	-9 53 43.4 ^{149.2}	-3 03.1	6.86	1.282 590	2 26 08
17	15 59 02.75 ⁻ 23.09	56.95	9 51 13.9 ^{+149.5}	3 03.6	6.90	.275 470	2 21 49
18	15 58 37.76 24.99	56.96	9 48 44.1 ^{149.8}	3 04.2	6.94	.268 536	2 17 28
19*	15 58 10.88 26.88	56.96	9 46 14.5 ^{149.6}	3 04.8	6.97	.261 790	2 13 06
20	15 57 42.15 28.73	56.97	9 43 45.2 ^{149.3}	3 05.5	7.01	.255 236	2 08 41
21	15 57 11.59 ⁻ 30.56	+0 56.97	-9 41 16.4 ^{148.8}	-3 06.2	7.05	1.248 877	2 04 15
22	15 56 39.23 ⁻ 32.36	56.96	9 38 48.5 ^{+147.9}	3 06.9	7.08	.242 714	1 59 46
23	15 56 05.12 34.11	56.96	9 36 21.6 ^{146.9}	3 07.6	7.12	.236 752	1 55 16
24	15 55 29.27 35.85	56.95	9 33 56.0 ^{145.6}	3 08.3	7.15	.230 992	1 50 45
25	15 54 51.73 37.54	56.95	9 31 31.9 ^{144.1}	3 09.1	7.18	.225 437	1 46 11
26	15 54 12.54 ⁻ 39.19	+0 56.96	-9 29 09.6 ^{142.3}	-3 09.9	7.21	1.220 090	1 41 36
27	15 53 31.73 ⁻ 40.81	56.96	9 26 49.2 ^{+140.4}	3 10.7	7.24	.214 953	1 37 00
28	15 52 49.35 42.38	56.97	9 24 31.1 ^{138.1}	3 11.6	7.27	.210 030	1 32 22
29	15 52 05.44 43.91	56.98	9 22 15.5 ^{135.6}	3 12.5	7.30	.205 323	1 27 42
30	15 51 20.05 45.39	56.98	9 20 02.7 ^{132.8}	3 13.5	7.33	.200 836	1 23 01
May 1	15 50 33.25 ⁻ 46.80	+0 56.99	-9 17 53.0 ^{129.7}	-3 14.5	7.35	1.196 570	1 18 18
2*	15 49 45.08 ⁻ 48.17	56.99	9 15 46.6 ^{+126.4}	3 15.6	7.38	.192 529	1 13 35
3	15 48 55.61 49.47	56.98	9 13 43.8 ^{122.8}	3 16.6	7.40	.188 715	1 08 49
4	15 48 04.91 50.70	56.98	9 11 44.9 ^{118.9}	3 17.7	7.43	.185 130	1 04 03
5	15 47 13.03 51.88	56.97	9 09 50.2 ^{114.7}	3 18.7	7.45	.181 778	0 59 16
6	15 46 20.07 ⁻ 52.96	+0 56.96	-9 08 00.0 ^{110.2}	-3 19.8	7.47	1.178 659	0 54 27
7	15 45 26.09 53.98	56.95	9 06 14.6 ^{+105.4}	3 20.9	7.48	.175 776	0 49 37
8	15 44 31.16 54.93	56.94	9 04 34.2 ^{100.4}	3 21.9	7.50	.173 131	0 44 47
9	15 43 35.38 55.78	56.94	9 02 59.3 ^{94.9}	3 23.0	7.52	.170 725	0 39 55
10	15 42 38.81 56.57	56.93	9 01 30.0 ^{89.3}	3 24.1	7.53	.168 559	0 35 03
11	15 41 41.55 ⁻ 57.26	+0 56.93	-9 00 06.6 ^{83.4}	-3 25.2	7.54	1.166 636	0 30 10
12	15 40 43.69 57.86	56.93	8 58 49.5 ^{+77.1}	3 26.4	7.55	.164 955	0 25 17
13	15 39 45.31 58.38	56.94	8 57 38.8 ^{70.7}	3 27.6	7.56	.163 517	0 20 23
14	15 38 46.50 58.81	56.94	8 56 34.8 ^{64.0}	3 28.8	7.57	.162 322	0 15 29
15	15 37 47.35 59.15	56.94	8 55 37.9 ^{56.9}	3 30.0	7.58	.161 372	0 10 34
16*	15 36 47.95 ⁻ 59.40	+0 56.94	-8 54 48.1 ^{49.8}	-3 31.2	7.58	1.160 666	0 05 39
17	15 35 48.39 59.56	+0 56.94	-8 54 05.8 ^{+42.3}	-3 32.4	7.58	1.160 203	{ 0 00 44 } { 23 55 49 }

Photographic Magnitude : Apr. 20, 6.4 ; May 10, 6.2

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

VESTA, 1967

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
May 17	^{h m s} 15 35 48.39 ^s	^{m s} +0 56.94	^{° ′ ″} - 8 54 05.8 [″]	^{′ ″} - 3 32.4 [″]	7.58	1.160 203	^{h m s} { 0 00 44 } { 23 55 49 }
18	15 34 48.77 ^s	56.94	8 53 31.1 [″]	3 33.6 [″]	7.59	.159 983	23 50 54
19	15 33 49.16 ^s	56.93	8 53 04.2 [″]	3 34.8 [″]	7.59	.160 006	23 45 59
20	15 32 49.66 ^s	56.92	8 52 45.3 [″]	3 35.9 [″]	7.58	.160 270	23 41 04
21	15 31 50.35 ^s	56.91	8 52 34.6 [″]	3 37.0 [″]	7.58	.160 774	23 36 09
22	15 30 51.31 ^s	+0 56.91	- 8 52 32.1 [″]	- 3 38.1 [″]	7.58	1.161 518	23 31 15
23	15 29 52.62 ^s	56.91	8 52 38.1 [″]	3 39.2 [″]	7.57	.162 500	23 26 21
24	15 28 54.37 ^s	56.91	8 52 52.6 [″]	3 40.3 [″]	7.56	.163 719	23 21 28
25	15 27 56.63 ^s	56.92	8 53 15.8 [″]	3 41.4 [″]	7.55	.165 174	23 16 35
26	15 26 59.47 ^s	56.93	8 53 47.7 [″]	3 42.5 [″]	7.54	.166 863	23 11 43
27	15 26 02.99 ^s	+0 56.93	- 8 54 28.5 [″]	- 3 43.6 [″]	7.53	1.168 785	23 06 52
28	15 25 07.24 ^s	56.94	8 55 18.2 [″]	3 44.7 [″]	7.52	.170 940	23 02 01
29*	15 24 12.31 ^s	56.94	8 56 17.0 [″]	3 45.8 [″]	7.50	.173 324	22 57 11
30	15 23 18.27 ^s	56.94	8 57 25.0 [″]	3 46.8 [″]	7.48	.175 938	22 52 23
31	15 22 25.19 ^s	56.94	8 58 42.2 [″]	3 47.8 [″]	7.47	.178 778	22 47 35
June 1	15 21 33.14 ^s	+0 56.94	- 9 00 08.6 [″]	- 3 48.8 [″]	7.45	1.181 844	22 42 48
2	15 20 42.21 ^s	56.93	9 01 44.4 [″]	3 49.7 [″]	7.43	.185 132	22 38 03
3	15 19 52.44 ^s	56.93	9 03 29.7 [″]	3 50.6 [″]	7.40	.188 640	22 33 19
4	15 19 03.91 ^s	56.93	9 05 24.3 [″]	3 51.5 [″]	7.38	.192 367	22 28 36
5	15 18 16.68 ^s	56.93	9 07 28.5 [″]	3 52.3 [″]	7.36	.196 310	22 23 54
6	15 17 30.81 ^s	+0 56.93	- 9 09 42.1 [″]	- 3 53.1 [″]	7.33	1.200 465	22 19 14
7	15 16 46.35 ^s	56.94	9 12 05.2 [″]	3 53.9 [″]	7.30	.204 830	22 14 35
8	15 16 03.37 ^s	56.95	9 14 37.7 [″]	3 54.6 [″]	7.28	.209 402	22 09 58
9	15 15 21.92 ^s	56.96	9 17 19.7 [″]	3 55.4 [″]	7.25	.214 178	22 05 22
10	15 14 42.04 ^s	56.97	9 20 11.2 [″]	3 56.1 [″]	7.22	.219 155	22 00 48
11	15 14 03.77 ^s	+0 56.99	- 9 23 12.0 [″]	- 3 56.8 [″]	7.19	1.224 329	21 56 16
12*	15 13 27.17 ^s	57.00	9 26 22.1 [″]	3 57.5 [″]	7.16	.229 696	21 51 45
13	15 12 52.27 ^s	57.01	9 29 41.5 [″]	3 58.2 [″]	7.12	.235 253	21 47 16
14	15 12 19.10 ^s	57.02	9 33 10.0 [″]	3 58.8 [″]	7.09	.240 997	21 42 49
15	15 11 47.69 ^s	57.02	9 36 47.5 [″]	3 59.4 [″]	7.06	.246 922	21 38 23
16	15 11 18.08 ^s	+0 57.03	- 9 40 34.0 [″]	- 3 59.9 [″]	7.02	1.253 027	21 34 00
17	15 10 50.28 ^s	57.04	9 44 29.2 [″]	4 00.4 [″]	6.99	.259 306	21 29 38
18	15 10 24.31 ^s	57.04	9 48 33.1 [″]	4 00.8 [″]	6.95	.265 756	21 25 18
19	15 10 00.19 ^s	57.06	9 52 45.5 [″]	4 01.1 [″]	6.92	.272 373	21 20 59
20	15 09 37.94 ^s	57.07	9 57 06.3 [″]	4 01.5 [″]	6.88	.279 154	21 16 43
21	15 09 17.56 ^s	+0 57.10	- 10 01 35.2 [″]	- 4 01.9 [″]	6.84	1.286 096	21 12 28
22	15 08 59.05 ^s	57.12	10 06 12.2 [″]	4 02.2 [″]	6.80	.293 195	21 08 16
23	15 08 42.44 ^s	57.15	10 10 57.1 [″]	4 02.5 [″]	6.77	.300 447	21 04 05
24	15 08 27.72 ^s	57.17	10 15 49.7 [″]	4 02.8 [″]	6.73	.307 851	20 59 56
25*	15 08 14.90 ^s	57.19	10 20 49.9 [″]	4 03.1 [″]	6.69	.315 401	20 55 49
26	15 08 03.99 ^s	+0 57.21	- 10 25 57.6 [″]	- 4 03.3 [″]	6.65	1.323 097	20 51 44
27	15 07 54.98 ^s	57.23	10 31 12.5 [″]	4 03.5 [″]	6.61	.330 933	20 47 41
28	15 07 47.88 ^s	57.25	10 36 34.6 [″]	4 03.6 [″]	6.57	.338 909	20 43 40
29	15 07 42.69 ^s	57.26	10 42 03.7 [″]	4 03.6 [″]	6.53	.347 019	20 39 40
30	15 07 39.42 ^s	57.28	10 47 39.6 [″]	4 03.7 [″]	6.49	.355 262	20 35 43
July 1	15 07 38.04 ^s	+0 57.30	- 10 53 22.3 [″]	- 4 03.6 [″]	6.45	1.363 634	20 31 47
2	15 07 38.58 ^s	+0 57.32	- 10 59 11.5 [″]	- 4 03.6 [″]	6.41	1.372 132	20 27 53

Photographic Magnitude : May 30, 6.2 ; June 19, 6.4

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
July	h m s	m s	° ' "	' "	"		h m s
	1 15 07 38.04 ^s	+0 57.30	-10 53 22.3	-4 03.6	6.45	1.363 634	20 31 47
	2 15 07 38.58 ^{+ 0.54}	57.32	10 59 11.5 -349.2	4 03.6	6.41	.372 132	20 27 53
	3 15 07 41.01 ^{2.43}	57.34	11 05 07.1 355.6	4 03.5	6.37	.380 753	20 24 02
	4 15 07 45.35 ^{4.34}	57.37	11 11 09.0 361.9	4 03.4	6.33	.389 493	20 20 12
	5 15 07 51.57 ^{6.22}	57.40	11 17 16.9 367.9	4 03.2	6.29	.398 350	20 16 23
	6 15 07 59.67 ^{8.10}	+0 57.43	-11 23 30.8 373.9	-4 03.1	6.25	1.407 320	20 12 37
	7 15 08 09.65 ^{+ 9.98}	57.47	11 29 50.5 -379.7	4 02.9	6.21	.416 400	20 08 53
	8 15 08 21.50 ^{11.85}	57.50	11 36 15.7 385.2	4 02.7	6.17	.425 587	20 05 10
	9* 15 08 35.20 ^{13.70}	57.54	11 42 46.5 390.8	4 02.5	6.13	.434 877	20 01 30
	10 15 08 50.75 ^{15.55}	57.57	11 49 22.4 395.9	4 02.3	6.09	.444 267	19 57 51
	11 15 09 08.13 ^{17.38}	+0 57.60	-11 56 03.5 401.1	-4 02.0	6.05	1.453 755	19 54 14
	12 15 09 27.32 ^{+ 19.19}	57.63	12 02 49.5 -406.0	4 01.6	6.01	.463 336	19 50 38
	13 15 09 48.30 ^{20.98}	57.66	12 09 40.3 410.8	4 01.2	5.97	.473 007	19 47 05
	14 15 10 11.07 ^{22.77}	57.69	12 16 35.6 415.3	4 00.8	5.93	.482 765	19 43 33
	15 15 10 35.59 ^{24.52}	57.72	12 23 35.2 419.6	4 00.3	5.90	.492 608	19 40 03
	16 15 11 01.86 ^{26.27}	+0 57.76	-12 30 39.0 423.8	-3 59.8	5.86	1.502 532	19 36 34
	17 15 11 29.84 ^{+ 27.98}	57.80	12 37 46.8 -427.8	3 59.2	5.82	.512 534	19 33 08
	18 15 11 59.52 ^{29.68}	57.84	12 44 58.3 431.5	3 58.6	5.78	.522 613	19 29 43
	19 15 12 30.88 ^{31.36}	57.89	12 52 13.5 435.2	3 58.1	5.74	.532 764	19 26 20
	20 15 13 03.89 ^{33.01}	57.94	12 59 32.1 438.6	3 57.5	5.70	.542 987	19 22 58
	21 15 13 38.54 ^{34.65}	+0 57.98	-13 06 53.9 441.8	-3 56.9	5.67	1.553 279	19 19 38
	22* 15 14 14.80 ^{+ 36.26}	58.03	13 14 18.9 -445.0	3 56.3	5.63	.563 638	19 16 19
	23 15 14 52.65 ^{37.85}	58.08	13 21 46.7 447.8	3 55.6	5.59	.574 062	19 13 02
	24 15 15 32.08 ^{39.43}	58.12	13 29 17.4 450.7	3 54.9	5.55	.584 548	19 09 47
	25 15 16 13.07 ^{40.99}	58.16	13 36 50.7 453.3	3 54.1	5.52	.595 095	19 06 33
	26 15 16 55.60 ^{42.53}	+0 58.20	-13 44 26.4 455.7	-3 53.3	5.48	1.605 702	19 03 21
	27 15 17 39.65 ^{+ 44.05}	58.24	13 52 04.5 -458.1	3 52.5	5.44	.616 365	19 00 10
	28 15 18 25.20 ^{45.55}	58.28	13 59 44.8 460.3	3 51.6	5.41	.627 083	18 57 00
	29 15 19 12.25 ^{47.05}	58.32	14 07 27.1 462.3	3 50.6	5.37	.637 854	18 53 53
	30 15 20 00.76 ^{48.51}	58.37	14 15 11.4 464.3	3 49.7	5.34	.648 677	18 50 46
	31 15 20 50.74 ^{49.98}	+0 58.42	-14 22 57.4 466.0	-3 48.7	5.30	1.659 548	18 47 41
Aug.	1 15 21 42.15 ^{+ 51.41}	58.47	14 30 45.1 -467.7	3 47.7	5.27	.670 467	18 44 38
	2 15 22 34.98 ^{52.83}	58.53	14 38 34.2 469.1	3 46.7	5.23	.681 431	18 41 35
	3 15 23 29.23 ^{54.25}	58.59	14 46 24.7 470.5	3 45.6	5.20	.692 437	18 38 35
	4 15 24 24.87 ^{55.64}	58.65	14 54 16.5 471.8	3 44.6	5.17	.703 485	18 35 35
	5 15 25 21.88 ^{57.01}	+0 58.71	-15 02 09.3 472.8	-3 43.5	5.13	1.714 572	18 32 37
	6* 15 26 20.26 ^{+ 58.38}	58.76	15 10 03.1 -473.8	3 42.5	5.10	.725 696	18 29 40
	7 15 27 19.98 ^{59.72}	58.82	15 17 57.8 474.7	3 41.3	5.07	.736 855	18 26 45
	8 15 28 21.03 ^{61.05}	58.87	15 25 53.1 475.3	3 40.2	5.03	.748 046	18 23 51
	9 15 29 23.39 ^{62.36}	58.92	15 33 48.9 475.8	3 38.9	5.00	.759 267	18 20 58
	10 15 30 27.04 ^{63.65}	+0 58.97	-15 41 45.1 476.2	-3 37.7	4.97	1.770 517	18 18 06
	11 15 31 31.96 ^{+ 64.92}	59.02	15 49 41.5 -476.4	3 36.3	4.94	.781 793	18 15 16
	12 15 32 38.14 ^{66.18}	59.08	15 57 37.9 476.4	3 35.0	4.91	.793 093	18 12 27
	13 15 33 45.55 ^{67.41}	59.14	16 05 34.4 476.5	3 33.6	4.88	.804 415	18 09 39
	14 15 34 54.17 ^{68.62}	59.20	16 13 30.6 476.2	3 32.2	4.85	.815 759	18 06 53
	15 15 36 04.00 ^{69.83}	+0 59.27	-16 21 26.4 475.8	-3 30.8	4.82	1.827 122	18 04 07
	16 15 37 15.00 ^{+ 71.00}	+0 59.34	-16 29 21.7 -475.3	-3 29.4	4.79	1.838 503	18 01 23

Photographic Magnitude : July 9, 6.7 ; July 29, 7.0

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

VESTA, 1967

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]	["]		^h ^m ^s
Aug. 16	15 37 15.00 + 72.16	+0 59.34	-16 29 21.7 -474.7	-3 29.4 4.79	1.838 503	18 01 23	
17	15 38 27.16 + 73.30	59.41	16 37 16.4 474.0	3 28.0 4.76	.849 901	17 58 40	
18	15 39 40.46 + 74.43	59.48	16 45 10.4 473.0	3 26.5 4.73	.861 314	17 55 58	
19*	15 40 54.89 + 75.54	59.54	16 53 03.4 472.1	3 25.0 4.70	.872 742	17 53 17	
20	15 42 10.43 + 76.64	59.60	17 00 55.5 470.9	3 23.5 4.67	.884 183	17 50 37	
21	15 43 27.07 + 77.72	+0 59.66	-17 08 46.4 -469.6	-3 22.0 4.64	1.895 636	17 47 58	
22	15 44 44.79 + 78.80	59.72	17 16 36.0 468.3	3 20.4 4.61	.907 100	17 45 20	
23	15 46 03.59 + 79.84	59.78	17 24 24.3 466.8	3 18.7 4.59	.918 574	17 42 44	
24	15 47 23.43 + 80.89	59.84	17 32 11.1 465.2	3 17.0 4.56	.930 057	17 40 08	
25	15 48 44.32 + 81.93	59.90	17 39 56.3 463.6	3 15.3 4.53	.941 548	17 37 34	
26	15 50 06.25 + 82.94	+0 59.96	-17 47 39.9 -461.7	-3 13.5 4.51	1.953 045	17 35 00	
27	15 51 29.19 + 83.96	1 00.02	17 55 21.6 459.9	3 11.7 4.48	.964 548	17 32 28	
28	15 52 53.15 + 84.95	00.09	18 03 01.5 457.8	3 09.9 4.45	.976 055	17 29 56	
29	15 54 18.10 + 85.93	00.16	18 10 39.3 455.8	3 08.1 4.43	.987 565	17 27 26	
30	15 55 44.03 + 86.92	00.23	18 18 15.1 453.5	3 06.3 4.40	1.999 078	17 24 56	
31	15 57 10.95 + 87.88	+1 00.31	-18 25 48.6 -451.2	-3 04.4 4.38	2.010 590	17 22 27	
Sept. 1	15 58 38.83 + 88.84	00.38	18 33 19.8 448.8	3 02.6 4.35	.022 102	17 20 00	
2	16 00 07.67 + 89.78	00.45	18 40 48.6 446.2	3 00.7 4.33	.033 612	17 17 33	
3*	16 01 37.45 + 90.71	00.52	18 48 14.8 443.6	2 58.8 4.30	.045 118	17 15 07	
4	16 03 08.16 + 91.64	00.59	18 55 38.4 440.9	2 56.9 4.28	.056 619	17 12 42	
5	16 04 39.80 + 92.55	+1 00.65	-19 02 59.3 -437.9	-2 54.9 4.26	2.068 113	17 10 18	
6	16 06 12.35 + 93.44	00.71	19 10 17.2 435.1	2 52.9 4.23	.079 600	17 07 55	
7	16 07 45.79 + 94.33	00.77	19 17 32.3 431.9	2 50.8 4.21	.091 076	17 05 33	
8	16 09 20.12 + 95.20	00.84	19 24 44.2 428.7	2 48.6 4.19	.102 542	17 03 12	
9	16 10 55.32 + 96.06	00.90	19 31 52.9 425.4	2 46.5 4.16	.113 994	17 00 51	
10	16 12 31.38 + 96.89	+1 00.98	-19 38 58.3 -422.0	-2 44.3 4.14	2.125 434	16 58 32	
11	16 14 08.27 + 97.73	01.05	19 46 00.3 418.4	2 42.1 4.12	.136 858	16 56 13	
12	16 15 46.00 + 98.55	01.13	19 52 58.7 414.8	2 39.9 4.10	.148 267	16 53 55	
13	16 17 24.55 + 99.34	01.20	19 59 53.5 411.1	2 37.7 4.07	.159 658	16 51 38	
14	16 19 03.89 + 100.14	01.28	20 06 44.6 407.2	2 35.5 4.05	.171 033	16 49 21	
15	16 20 44.03 + 100.92	+1 01.35	-20 13 31.8 -403.3	-2 33.3 4.03	2.182 389	16 47 06	
16*	16 22 24.95 + 101.69	01.42	20 20 15.1 399.2	2 31.0 4.01	.193 726	16 44 51	
17	16 24 06.64 + 102.45	01.48	20 26 54.3 395.2	2 28.7 3.99	.205 044	16 42 37	
18	16 25 49.09 + 103.19	01.54	20 33 29.5 390.9	2 26.4 3.97	.216 341	16 40 24	
19	16 27 32.28 + 103.94	01.60	20 40 00.4 386.6	2 24.0 3.95	.227 617	16 38 11	
20	16 29 16.22 + 104.67	+1 01.66	-20 46 27.0 -382.3	-2 21.6 3.93	2.238 872	16 35 59	
21	16 31 00.89 + 105.38	01.72	20 52 49.3 377.8	2 19.2 3.91	.250 104	16 33 48	
22	16 32 46.27 + 106.10	01.78	20 59 07.1 373.2	2 16.7 3.89	.261 313	16 31 38	
23	16 34 32.37 + 106.81	01.84	21 05 20.3 368.6	2 14.1 3.87	.272 499	16 29 28	
24	16 36 19.18 + 107.50	01.91	21 11 28.9 364.0	2 11.6 3.85	.283 660	16 27 19	
25	16 38 06.68 + 108.19	+1 01.98	-21 17 32.9 -359.1	-2 09.0 3.83	2.294 795	16 25 11	
26	16 39 54.87 + 108.88	02.05	21 23 32.0 354.3	2 06.5 3.82	.305 904	16 23 03	
27	16 41 43.75 + 109.54	02.12	21 29 26.3 349.3	2 03.9 3.80	.316 985	16 20 56	
28	16 43 33.29 + 110.21	02.19	21 35 15.6 344.3	2 01.3 3.78	.328 039	16 18 50	
29	16 45 23.50 + 110.87	02.25	21 40 59.9 339.2	1 58.8 3.76	.339 063	16 16 44	
30	16 47 14.37 + 111.51	+1 02.32	-21 46 39.1 -334.0	-1 56.2 3.74	2.350 057	16 14 39	
Oct. 1*	16 49 05.88 + 112.15	+1 02.38	-21 52 13.1 -329.0	-1 53.5 3.73	2.361 020	16 12 35	

Photographic Magnitude : Aug. 18, 7.2 ; Sept. 7, 7.5 ; Sept. 27, 7.7

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

VESTA, 1967
FOR 0^h EPHEMERIS TIME

257

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]	["]		^h ^m ^s
Oct. 1*	16 49 05.88 ^s _{+112.16}	+1 02.38	-21 52 13.1 ["] _{-328.7}	-1 53.5	3.73	2.361 020	16 12 35
2	16 50 58.04 ^s _{112.79}	02.43	21 57 41.8 ["] _{323.4}	1 50.9	3.71	371 950	16 10 31
3	16 52 50.83 ^s _{113.42}	02.49	22 03 05.2 ["] _{318.0}	1 48.2	3.69	382 847	16 08 28
4	16 54 44.25 ^s _{114.03}	02.54	22 08 23.2 ["] _{312.5}	1 45.4	3.68	393 708	16 06 25
5	16 56 38.28 ^s _{114.62}	02.59	22 13 35.7 ["] _{306.8}	1 42.6	3.66	404 533	16 04 24
6	16 58 32.90 ^s _{+115.22}	+1 02.64	-22 18 42.5 ["] _{-301.2}	-1 39.8	3.64	2.415 320	16 02 22
7	17 00 28.12 ^s _{115.80}	02.70	22 23 43.7 ["] _{295.5}	1 36.9	3.63	426 069	16 00 22
8	17 02 23.92 ^s _{116.37}	02.76	22 28 39.2 ["] _{289.6}	1 34.1	3.61	436 777	15 58 21
9	17 04 20.29 ^s _{116.92}	02.83	22 33 28.8 ["] _{283.8}	1 31.2	3.60	447 445	15 56 22
10	17 06 17.21 ^s _{117.47}	02.89	22 38 12.6 ["] _{277.7}	1 28.4	3.58	458 072	15 54 23
11	17 08 14.68 ^s _{+118.00}	+1 02.95	-22 42 50.3 ["] _{-271.7}	-1 25.5	3.56	2.468 657	15 52 24
12	17 10 12.68 ^s _{118.52}	03.01	22 47 22.0 ["] _{265.7}	1 22.6	3.55	479 198	15 50 26
13	17 12 11.20 ^s _{119.03}	03.06	22 51 47.7 ["] _{259.4}	1 19.8	3.53	489 697	15 48 29
14	17 14 10.23 ^s _{119.54}	03.10	22 56 07.1 ["] _{253.2}	1 16.9	3.52	500 152	15 46 32
15*	17 16 09.77 ^s _{120.03}	03.15	23 00 20.3 ["] _{246.9}	1 13.9	3.51	510 562	15 44 35
16	17 18 09.80 ^s _{+120.52}	+1 03.18	-23 04 27.2 ["] _{-240.6}	-1 10.9	3.49	2.520 928	15 42 39
17	17 20 10.32 ^s _{120.99}	03.22	23 08 27.8 ["] _{234.1}	1 07.9	3.48	531 248	15 40 44
18	17 22 11.31 ^s _{121.47}	03.26	23 12 21.9 ["] _{227.7}	1 04.9	3.46	541 523	15 38 49
19	17 24 12.78 ^s _{121.92}	03.30	23 16 09.6 ["] _{221.2}	1 01.8	3.45	551 751	15 36 54
20	17 26 14.70 ^s _{122.37}	03.34	23 19 50.8 ["] _{214.6}	0 58.7	3.43	561 932	15 35 00
21	17 28 17.07 ^s _{+122.82}	+1 03.38	-23 23 25.4 ["] _{-208.0}	-0 55.6	3.42	2.572 066	15 33 06
22	17 30 19.89 ^s _{123.26}	03.42	23 26 53.4 ["] _{201.3}	0 52.5	3.41	582 152	15 31 13
23	17 32 23.15 ^s _{123.68}	03.46	23 30 14.7 ["] _{194.7}	0 49.4	3.39	592 189	15 29 20
24	17 34 26.83 ^s _{124.10}	03.50	23 33 29.4 ["] _{187.8}	0 46.3	3.38	602 176	15 27 28
25	17 36 30.93 ^s _{124.52}	03.54	23 36 37.2 ["] _{181.1}	0 43.2	3.37	612 114	15 25 36
26	17 38 35.45 ^s _{+124.93}	+1 03.58	-23 39 38.3 ["] _{-174.2}	-0 40.1	3.36	2.622 000	15 23 44
27	17 40 40.38 ^s _{125.33}	03.62	23 42 32.5 ["] _{167.2}	0 36.9	3.34	631 835	15 21 53
28	17 42 45.71 ^s _{125.71}	03.65	23 45 19.7 ["] _{160.4}	0 33.8	3.33	641 616	15 20 02
29	17 44 51.42 ^s _{126.10}	03.68	23 48 00.1 ["] _{153.3}	0 30.7	3.32	651 345	15 18 12
30*	17 46 57.52 ^s _{126.48}	03.70	23 50 33.4 ["] _{146.4}	0 27.5	3.31	661 018	15 16 22
31	17 49 04.00 ^s _{+126.84}	+1 03.72	-23 52 59.8 ["] _{-139.2}	-0 24.3	3.30	2.670 636	15 14 32
Nov. 1	17 51 10.84 ^s _{127.20}	03.73	23 55 19.0 ["] _{132.1}	0 21.1	3.28	680 196	15 12 43
2	17 53 18.04 ^s _{127.54}	03.75	23 57 31.1 ["] _{125.0}	0 17.8	3.27	689 699	15 10 54
3	17 55 25.58 ^s _{127.88}	03.77	23 59 36.1 ["] _{117.7}	0 14.5	3.26	699 142	15 09 05
4	17 57 33.46 ^s _{128.21}	03.80	24 01 33.8 ["] _{110.5}	0 11.2	3.25	708 525	15 07 17
5	17 59 41.67 ^s _{+128.51}	+1 03.83	-24 03 24.3 ["] _{-103.2}	-0 07.9	3.24	2.717 847	15 05 29
6	18 01 50.18 ^s _{128.82}	03.85	24 05 07.5 ["] _{96.0}	0 04.6	3.23	727 107	15 03 41
7	18 03 59.00 ^s _{129.11}	03.88	24 06 43.5 ["] _{88.6}	-0 01.4	3.22	736 304	15 01 54
8	18 06 08.11 ^s _{129.39}	03.89	24 08 12.1 ["] _{81.2}	+0 01.9	3.21	745 438	15 00 06
9	18 08 17.50 ^s _{129.65}	03.91	24 09 33.3 ["] _{73.9}	0 05.1	3.19	754 508	14 58 20
10	18 10 27.15 ^s _{+129.92}	+1 03.92	-24 10 47.2 ["] _{-66.4}	+0 08.4	3.18	2.763 514	14 56 33
11	18 12 37.07 ^s _{130.16}	03.92	24 11 53.6 ["] _{59.1}	0 11.6	3.17	772 455	14 54 47
12*	18 14 47.23 ^s _{130.41}	03.92	24 12 52.7 ["] _{51.5}	0 14.9	3.16	781 332	14 53 01
13	18 16 57.64 ^s _{130.64}	03.92	24 13 44.2 ["] _{44.2}	0 18.2	3.15	790 142	14 51 15
14	18 19 08.28 ^s _{130.86}	03.91	24 14 28.4 ["] _{36.6}	0 21.6	3.14	798 887	14 49 29
15	18 21 19.14 ^s _{+131.07}	+1 03.91	-24 15 05.0 ["] _{-29.2}	+0 24.9	3.13	2.807 566	14 47 44
16	18 23 30.21 ^s	+1 03.90	-24 15 34.2 ["]	+0 28.3	3.12	2.816 178	14 45 58

Photographic Magnitude : Oct. 17, 7.9 ; Nov. 6, 8.1 ; Nov. 26, 8.2

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

FOR 0^h EPHEMERIS TIME

Date	A	B	C	D	E	dψ	dε	τ	S.T.
					(0 ^s .0001)	(0 ^s .001)			^b
Jan. 0	- 4.447	-6.166	- 2.885	+20.212	-16	+214	+ 9	-0.0028	6.6
1	4.381	6.229	3.214	20.155	16	+184	+ 60	- .0001	6.7
2	4.335	6.278	3.542	20.091	16	+106	+ 96	+ .0026	6.7
3	4.299	6.303	3.870	20.021	16	+ 3	+108	.0054	6.8
4	4.262	6.305	4.196	19.945	16	- 98	+ 96	.0081	6.9
5	- 4.214	-6.285	- 4.522	+19.862	-16	-169	+ 61	+0.0108	6.9
6	4.148	6.252	4.847	19.772	16	-195	+ 13	.0136	7.0
7	4.061	6.219	5.170	19.676	16	-167	- 36	.0163	7.1
8	3.956	6.196	5.492	19.574	16	- 94	- 76	.0191	7.1
9	3.841	6.192	5.812	19.465	16	+ 6	- 97	.0218	7.2
10	- 3.725	-6.210	- 6.130	+19.349	-16	+111	- 97	+0.0245	7.3
11	3.616	6.248	6.446	19.226	15	+198	- 77	.0273	7.3
12	3.521	6.302	6.760	19.097	15	+251	- 42	.0300	7.4
13	3.443	6.362	7.072	18.962	15	+261	- 1	.0327	7.5
14	3.384	6.423	7.381	18.821	15	+226	+ 40	.0355	7.5
15	- 3.339	-6.475	- 7.688	+18.673	-15	+157	+ 72	+0.0382	7.6
16	3.304	6.516	7.991	18.519	15	+ 62	+ 92	.0410	7.6
17	3.275	6.540	8.292	18.360	15	- 43	+ 95	.0437	7.7
18	3.244	6.548	8.590	18.195	16	-144	+ 82	.0464	7.8
19	3.205	6.541	8.884	18.024	16	-224	+ 53	.0492	7.8
20	- 3.154	-6.526	- 9.176	+17.848	-16	-273	+ 15	+0.0519	7.9
21	3.088	6.504	9.464	17.667	16	-280	- 29	.0546	8.0
22	3.003	6.487	9.749	17.480	15	-242	- 69	.0574	8.0
23	2.903	6.482	10.031	17.288	15	-162	- 98	.0601	8.1
24	2.792	6.494	10.310	17.091	15	- 53	-109	.0629	8.2
25	- 2.679	-6.531	-10.585	+16.889	-15	+ 63	- 96	+0.0656	8.2
26	2.574	6.591	10.857	16.683	15	+159	- 60	.0683	8.3
27	2.488	6.667	11.126	16.472	15	+210	- 9	.0711	8.4
28	2.425	6.746	11.391	16.256	15	+203	+ 46	.0738	8.4
29	2.386	6.815	11.653	16.035	15	+140	+ 90	.0766	8.5
30	- 2.361	-6.860	-11.912	+15.809	-15	+ 41	+110	+0.0793	8.6
31	2.339	6.878	12.168	15.578	15	- 63	+103	.0820	8.6
Feb. 1	2.308	6.872	12.420	15.342	15	-142	+ 72	.0848	8.7
2	2.259	6.851	12.668	15.101	15	-177	+ 26	.0875	8.8
3	2.191	6.826	12.913	14.856	15	-161	- 24	.0902	8.8
4	- 2.106	-6.808	-13.154	+14.605	-15	- 99	- 67	+0.0930	8.9
5	2.008	6.807	13.391	14.349	15	- 6	- 93	.0957	9.0
6	1.909	6.827	13.623	14.089	14	+ 95	- 98	.0985	9.0
7	1.814	6.866	13.851	13.824	14	+185	- 84	.1012	9.1
8	1.732	6.922	14.075	13.554	14	+245	- 53	.1039	9.2
9	- 1.665	-6.987	-14.294	+13.280	-14	+267	- 13	+0.1067	9.2
10	1.617	7.053	14.508	13.001	14	+245	+ 29	.1094	9.3
11	1.585	7.113	14.717	12.719	14	+183	+ 64	.1121	9.4
12	1.564	7.161	14.921	12.432	14	+ 94	+ 88	.1149	9.4
13	1.551	7.193	15.120	12.141	15	- 11	+ 96	.1176	9.5
14	- 1.537	-7.208	-15.314	+11.847	-15	-114	+ 87	+0.1204	9.6
15	- 1.519	-7.209	-15.503	+11.549	-15	-203	+ 64	+0.1231	9.6

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
	^s	["]	^{h m s}	["]	^{h m s}	["]	(0 ^s .0001)	(0 ["] .001)	^{h m}
Jan. 0	-0.6836	7.602	15 36 48	20.417	23 27 30	-1.251	+131	86	23 36
1	.6735	7.615	15 39 31	20.410	23 23 46	1.394	+113	95	21 23
2	.6664	7.629	15 41 30	20.401	23 20 00	1.536	+ 65	105	19 35
3	.6609	7.629	15 42 49	20.392	23 16 14	1.678	+ 2	108	18 02
4	.6553	7.610	15 43 46	20.382	23 12 28	1.820	- 60	104	16 32
5	-0.6479	7.567	15 44 38	20.370	23 08 42	-1.961	-103	91	14 49
6	.6378	7.503	15 45 45	20.357	23 04 54	2.102	-119	79	12 38
7	.6244	7.427	15 47 25	20.344	23 01 07	2.242	-102	76	10 06
8	.6084	7.351	15 49 46	20.330	22 57 19	2.382	- 57	85	7 45
9	.5907	7.287	15 52 45	20.314	22 53 30	2.520	+ 4	97	5 55
10	-0.5728	7.242	15 56 10	20.297	22 49 41	-2.658	+ 68	107	4 22
11	.5561	7.219	15 59 46	20.278	22 45 52	2.795	+121	110	2 57
12	.5415	7.219	16 03 14	20.258	22 42 02	2.931	+154	108	1 31
13	.5296	7.234	16 06 19	20.238	22 38 11	3.067	+160	104	0 02
14	.5205	7.260	16 08 52	20.217	22 34 21	3.201	+138	98	22 24
15	-0.5136	7.285	16 10 53	20.194	22 30 29	-3.334	+ 96	95	20 44
16	.5083	7.306	16 12 27	20.170	22 26 38	3.465	+ 38	95	19 00
17	.5038	7.314	16 13 36	20.146	22 22 47	3.596	- 26	97	17 19
18	.4990	7.308	16 14 35	20.121	22 18 55	3.725	- 88	100	15 40
19	.4931	7.284	16 15 35	20.095	22 15 03	3.852	-137	104	14 03
20	-0.4853	7.248	16 16 49	20.069	22 11 10	-3.979	-167	110	12 31
21	.4751	7.200	16 18 25	20.042	22 07 17	4.104	-171	115	11 02
22	.4622	7.148	16 20 38	20.015	22 03 24	4.228	-148	119	9 37
23	.4468	7.102	16 23 30	19.987	21 59 30	4.350	- 99	117	8 13
24	.4297	7.069	16 26 56	19.960	21 55 36	4.471	- 32	111	6 44
25	-0.4123	7.059	16 30 47	19.932	21 51 42	-4.590	+ 39	99	5 02
26	.3963	7.076	16 34 40	19.905	21 47 47	4.708	+ 97	87	2 54
27	.3830	7.116	16 38 09	19.878	21 43 51	4.825	+128	84	0 25
28	.3734	7.169	16 40 55	19.850	21 39 55	4.940	+124	93	22 01
29	.3674	7.221	16 42 49	19.822	21 35 59	5.053	+ 86	106	20 07
30	-0.3635	7.255	16 44 02	19.794	21 32 01	-5.166	+ 25	111	18 34
31	.3602	7.265	16 44 52	19.767	21 28 02	5.277	- 39	106	17 05
Feb. 1	.3554	7.249	16 45 44	19.739	21 24 02	5.386	- 87	91	15 28
2	.3480	7.214	16 47 00	19.711	21 20 02	5.493	-108	75	13 21
3	.3375	7.169	16 48 49	19.684	21 16 01	5.600	- 98	68	10 38
4	-0.3244	7.126	16 51 15	19.655	21 11 58	-5.704	- 61	78	8 02
5	.3095	7.097	16 54 16	19.627	21 07 55	5.807	- 4	93	6 06
6	.2942	7.089	16 57 31	19.598	21 03 51	5.908	+ 58	105	4 36
7	.2796	7.102	17 00 48	19.569	20 59 47	6.006	+113	112	3 15
8	.2670	7.135	17 03 49	19.540	20 55 41	6.104	+150	111	1 54
9	-0.2568	7.183	17 06 23	19.511	20 51 34	-6.198	+163	107	0 28
10	.2494	7.236	17 08 21	19.481	20 47 27	6.291	+150	102	22 54
11	.2445	7.287	17 09 45	19.452	20 43 20	6.382	+112	97	21 15
12	.2414	7.330	17 10 43	19.421	20 39 12	6.470	+ 57	96	19 32
13	.2394	7.358	17 11 20	19.391	20 35 03	6.557	- 7	96	17 50
14	-0.2372	7.370	17 11 51	19.362	20 30 54	-6.641	- 70	98	16 10
15	-0.2344	7.367	17 12 24	19.332	20 26 44	-6.723	-124	103	14 34

BESSELIAN DAY NUMBERS, 1967

FOR 0^h EPHEMERIS TIME

Date	A	B	C	D	E	dψ	dε	τ	S.T.
					(0 ^s .0001)	(0 ^s .001)			^h
Feb. 15	- 1.519	-7.209	-15.503	+11.549	-15	-203	+ 64	+0.1231	9.6
16	1.489	7.197	15.686	11.248	15	-263	+ 28	.1258	9.7
17	1.446	7.178	15.865	10.944	15	-286	- 14	.1286	9.8
18	1.386	7.159	16.038	10.637	15	-267	- 55	.1313	9.8
19	1.310	7.148	16.206	10.327	15	-207	- 89	.1340	9.9
20	- 1.222	-7.151	-16.369	+10.014	-15	-113	-108	+0.1368	9.9
21	1.127	7.176	16.526	9.699	15	- 1	-105	.1395	10.0
22	1.034	7.224	16.678	9.382	14	+105	- 78	.1423	10.1
23	0.956	7.292	16.826	9.062	14	+178	- 31	.1450	10.1
24	0.898	7.368	16.968	8.739	14	+198	+ 25	.1477	10.2
25	- 0.866	-7.440	-17.106	+ 8.415	-14	+158	+ 77	+0.1505	10.3
26	0.852	7.491	17.239	8.088	15	+ 71	+108	.1532	10.3
27	0.847	7.514	17.367	7.759	15	- 36	+112	.1559	10.4
28	0.836	7.508	17.489	7.428	15	-126	+ 87	.1587	10.5
Mar. 1	0.807	7.480	17.607	7.094	15	-173	+ 41	.1614	10.5
2	- 0.758	-7.445	-17.720	+ 6.758	-15	-166	- 11	+0.1642	10.6
3	0.689	7.415	17.827	6.419	15	-108	- 58	.1669	10.7
4	0.607	7.401	17.929	6.079	15	- 15	- 89	.1696	10.7
5	0.520	7.406	18.026	5.736	15	+ 89	- 99	.1724	10.8
6	0.438	7.433	18.117	5.392	15	+183	- 88	.1751	10.9
7	- 0.366	-7.474	-18.202	+ 5.045	-15	+250	- 61	+0.1779	10.9
8	0.309	7.526	18.281	4.697	15	+280	- 23	.1806	11.0
9	0.270	7.582	18.355	4.347	15	+268	+ 19	.1833	11.1
10	0.247	7.633	18.422	3.996	15	+215	+ 57	.1861	11.1
11	0.237	7.672	18.484	3.644	15	+131	+ 84	.1888	11.2
12	- 0.235	-7.696	-18.539	+ 3.291	-15	+ 28	+ 97	+0.1915	11.3
13	0.234	7.703	18.589	2.937	15	- 78	+ 93	.1943	11.3
14	0.228	7.693	18.632	2.582	16	-173	+ 73	.1970	11.4
15	0.213	7.670	18.670	2.227	16	-242	+ 40	.1998	11.5
16	0.184	7.638	18.702	1.872	16	-278	- 1	.2025	11.5
17	- 0.139	-7.604	-18.728	+ 1.517	-16	-273	- 43	+0.2052	11.6
18	0.079	7.576	18.748	1.161	16	-229	- 79	.2080	11.7
19	- 0.006	7.559	18.762	0.806	16	-151	-103	.2107	11.7
20	+ 0.076	7.560	18.771	0.451	16	- 51	-108	.2134	11.8
21	0.160	7.582	18.774	+ 0.096	16	+ 51	- 91	.2162	11.9
22	+ 0.235	-7.625	-18.772	- 0.258	-15	+134	- 53	+0.2189	11.9
23	0.294	7.683	18.764	0.611	15	+175	0	.2217	12.0
24	0.330	7.741	18.750	0.963	16	+159	+ 55	.2244	12.1
25	0.346	7.787	18.732	1.315	16	+ 90	+ 98	.2271	12.1
26	0.348	7.806	18.708	1.666	16	- 12	+115	.2299	12.2
27	+ 0.350	-7.794	-18.680	- 2.016	-16	-114	+101	+0.2326	12.2
28	0.366	7.756	18.646	2.366	16	-181	+ 62	.2353	12.3
29	0.406	7.702	18.607	2.715	16	-190	+ 8	.2381	12.4
30	0.468	7.649	18.563	3.064	16	-141	- 45	.2408	12.4
31	0.549	7.609	18.513	3.411	16	- 48	- 84	.2436	12.5
Apr. 1	+ 0.637	-7.592	-18.458	- 3.758	-16	+ 65	-100	+0.2463	12.6
2	+ 0.724	-7.596	-18.397	- 4.104	-16	+172	- 94	+0.2490	12.6

INDEPENDENT DAY NUMBERS, 1967

261

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
	^s	["]	^{h m s}	["]	^{h m s}	["]	(0 ^s .0001)	(0 ["] .001)	^{h m}
Feb. 15	-0.2344	7.367	17 12 24	19.332	20 26 44	-6.723	-124	103	14 34
16	.2299	7.349	17 13 15	19.302	20 22 34	6.802	-161	109	12 59
17	.2232	7.322	17 14 26	19.273	20 18 24	6.880	-175	114	11 32
18	.2140	7.292	17 16 10	19.245	20 14 13	6.955	-163	120	10 10
19	.2024	7.267	17 18 27	19.217	20 10 01	7.028	-127	121	8 51
20	-0.1888	7.255	17 21 13	19.189	20 05 50	-7.098	- 69	117	7 30
21	.1742	7.264	17 24 18	19.162	20 01 38	7.166	- 1	105	6 01
22	.1601	7.298	17 27 25	19.136	19 57 26	7.232	+ 64	89	4 07
23	.1480	7.354	17 30 07	19.111	19 53 13	7.296	+109	77	1 35
24	.1392	7.423	17 32 12	19.086	19 49 00	7.358	+121	83	22 49
25	-0.1342	7.490	17 33 27	19.064	19 44 46	-7.418	+ 97	99	20 37
26	.1322	7.539	17 34 03	19.042	19 40 32	7.476	+ 43	112	18 59
27	.1314	7.562	17 34 16	19.022	19 36 18	7.531	- 22	113	17 31
28	.1296	7.554	17 34 35	19.001	19 32 03	7.584	- 77	100	16 00
Mar. 1	.1253	7.523	17 35 22	18.982	19 27 47	7.635	-106	80	14 03
2	-0.1178	7.483	17 36 45	18.965	19 23 30	-7.684	-102	67	11 22
3	.1072	7.447	17 38 46	18.947	19 19 12	7.731	- 66	72	8 26
4	.0945	7.426	17 41 15	18.931	19 14 55	7.775	- 9	89	6 15
5	.0812	7.424	17 43 56	18.917	19 10 36	7.817	+ 54	105	4 41
6	.0686	7.446	17 46 31	18.903	19 06 18	7.856	+112	114	3 22
7	-0.0576	7.483	17 48 47	18.888	19 01 58	-7.893	+153	117	2 06
8	.0489	7.532	17 50 36	18.875	18 57 38	7.927	+171	114	0 47
9	.0429	7.587	17 51 50	18.863	18 53 18	7.959	+164	108	23 20
10	.0394	7.637	17 52 35	18.850	18 48 57	7.989	+132	103	21 45
11	.0379	7.676	17 52 55	18.840	18 44 37	8.015	+ 80	99	20 08
12	-0.0375	7.700	17 53 00	18.829	18 40 16	-8.039	+ 17	98	18 26
13	.0374	7.706	17 53 02	18.820	18 35 55	8.061	- 48	98	16 46
14	.0365	7.696	17 53 12	18.810	18 31 34	8.080	-106	100	15 07
15	.0342	7.673	17 53 38	18.802	18 27 13	8.096	-148	104	13 30
16	.0299	7.640	17 54 29	18.795	18 22 52	8.110	-170	111	11 58
17	-0.0230	7.605	17 55 49	18.789	18 18 31	-8.121	-167	117	10 34
18	.0138	7.576	17 57 37	18.784	18 14 10	8.130	-140	121	9 16
19	- 0.0025	7.559	17 59 49	18.779	18 09 50	8.136	- 92	119	8 01
20	+ 0.0102	7.560	18 02 18	18.776	18 05 30	8.140	- 31	110	6 42
21	.0229	7.584	18 04 50	18.775	18 01 10	8.141	+ 31	93	5 10
22	+0.0345	7.629	18 07 04	18.774	17 56 51	-8.140	+ 82	75	2 59
23	.0435	7.689	18 08 46	18.774	17 52 32	8.137	+107	70	0 00
24	.0491	7.748	18 09 46	18.775	17 48 14	8.131	+ 97	84	21 16
25	.0514	7.795	18 10 10	18.778	17 43 56	8.123	+ 55	104	19 20
26	.0517	7.814	18 10 13	18.782	17 39 39	8.113	- 7	115	17 51
27	+0.0521	7.802	18 10 17	18.789	17 35 22	-8.100	- 70	111	16 23
28	.0545	7.765	18 10 48	18.796	17 31 04	8.086	-111	95	14 43
29	.0606	7.713	18 12 04	18.804	17 26 48	8.069	-116	76	12 24
30	.0702	7.663	18 14 00	18.814	17 22 31	8.050	- 86	72	9 25
31	.0826	7.629	18 16 30	18.825	17 18 14	8.028	- 29	86	6 51
Apr. 1	+0.0962	7.619	18 19 11	18.837	17 13 58	-8.004	+ 40	103	5 02
2	+0.1095	7.630	18 21 47	18.849	17 09 42	-7.978	+105	116	3 36

BESSELIAN DAY NUMBERS, 1967

FOR 0^h EPHEMERIS TIME

Date	A	B	C	D	E	dψ	dε	τ	S.T.
					(0 ^s .0001)	(0 ^s .001)			^h
Apr. 1	+ 0.637	-7.592	-18.458	- 3.758	-16	+ 65	-100	+0.2463	12.6
2	0.724	7.596	18.397	4.104	16	+172	- 94	.2490	12.6
3	0.800	7.617	18.332	4.449	16	+252	- 70	.2518	12.7
4	0.861	7.652	18.260	4.793	16	+293	- 32	.2545	12.8
5	0.905	7.690	18.183	5.136	16	+291	+ 10	.2573	12.8
6	+ 0.932	-7.724	-18.100	- 5.477	-16	+247	+ 49	+0.2600	12.9
7	0.946	7.750	18.012	5.817	16	+170	+ 80	.2627	13.0
8	0.952	7.762	17.917	6.155	16	+ 70	+ 97	.2655	13.0
9	0.956	7.756	17.818	6.490	16	- 37	+ 97	.2682	13.1
10	0.962	7.733	17.713	6.824	17	-137	+ 81	.2709	13.2
11	+ 0.978	-7.696	-17.602	- 7.155	-17	-215	+ 51	+0.2737	13.2
12	1.007	7.649	17.487	7.484	17	-259	+ 11	.2764	13.3
13	1.052	7.598	17.365	7.810	17	-266	- 32	.2792	13.4
14	1.113	7.551	17.239	8.133	17	-233	- 70	.2819	13.4
15	1.188	7.515	17.108	8.454	17	-165	- 97	.2846	13.5
16	+ 1.273	-7.496	-16.972	- 8.771	-17	- 75	-107	+0.2874	13.6
17	1.360	7.495	16.830	9.085	17	+ 21	- 98	.2901	13.6
18	1.443	7.516	16.685	9.397	16	+104	- 67	.2928	13.7
19	1.513	7.552	16.534	9.704	16	+154	- 21	.2956	13.8
20	1.564	7.595	16.379	10.009	16	+156	+ 33	.2983	13.8
21	+ 1.595	-7.632	-16.220	-10.310	-17	+105	+ 81	+0.3011	13.9
22	1.609	7.650	16.057	10.608	17	+ 12	+110	.3038	14.0
23	1.619	7.638	15.889	10.902	17	- 95	+110	.3065	14.0
24	1.638	7.597	15.717	11.193	17	-181	+ 81	.3093	14.1
25	1.676	7.535	15.541	11.481	17	-218	+ 31	.3120	14.2
26	+ 1.741	-7.466	-15.361	-11.766	-17	-190	- 26	+0.3147	14.2
27	1.828	7.406	15.177	12.048	17	-106	- 73	.3175	14.3
28	1.930	7.367	14.989	12.327	17	+ 11	-100	.3202	14.4
29	2.033	7.353	14.797	12.602	17	+132	-101	.3230	14.4
30	2.129	7.360	14.600	12.874	16	+232	- 81	.3257	14.5
May 1	+ 2.209	-7.383	-14.399	-13.143	-16	+292	- 45	+0.3284	14.5
2	2.272	7.411	14.194	13.408	16	+306	- 3	.3312	14.6
3	2.316	7.440	13.985	13.670	16	+275	+ 39	.3339	14.7
4	2.347	7.461	13.771	13.927	16	+205	+ 73	.3367	14.7
5	2.368	7.468	13.554	14.181	16	+110	+ 94	.3394	14.8
6	+ 2.384	-7.460	-13.332	-14.430	-17	+ 3	+ 99	+0.3421	14.9
7	2.403	7.434	13.106	14.676	17	-100	+ 87	.3449	14.9
8	2.430	7.394	12.877	14.916	17	-185	+ 60	.3476	15.0
9	2.469	7.343	12.643	15.152	17	-239	+ 22	.3503	15.1
10	2.524	7.287	12.406	15.384	17	-255	- 20	.3531	15.1
11	+ 2.596	-7.234	-12.165	-15.611	-17	-231	- 60	+0.3558	15.2
12	2.682	7.190	11.920	15.832	17	-170	- 91	.3586	15.3
13	2.780	7.163	11.672	16.049	17	- 83	-105	.3613	15.3
14	2.881	7.155	11.421	16.261	16	+ 11	-100	.3640	15.4
15	2.979	7.168	11.167	16.468	16	+ 96	- 75	.3668	15.5
16	+ 3.065	-7.196	-10.910	-16.669	-16	+151	- 34	+0.3695	15.5
17	+ 3.134	-7.235	-10.650	-16.866	-16	+161	+ 17	+0.3722	15.6

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
							(0 ^s .0001)	(0 ^s .001)	
			^{h m s}		^{h m s}			^{h m}	
Apr. 1	+0.0962	7.619	18 19 11	18.837	17 13 58	-8.004	+ 40	103	5 02
2	.1095	7.630	18 21 47	18.849	17 09 42	7.978	+105	116	3 36
3	.1211	7.659	18 23 59	18.864	17 05 26	7.950	+154	122	2 20
4	.1304	7.700	18 25 41	18.879	17 01 10	7.918	+179	121	1 01
5	.1372	7.743	18 26 51	18.895	16 56 55	7.885	+178	116	23 40
6	+0.1414	7.780	18 27 31	18.911	16 52 39	-7.849	+151	110	22 14
7	.1435	7.808	18 27 50	18.928	16 48 25	7.811	+104	105	20 41
8	.1444	7.820	18 27 58	18.945	16 44 10	7.770	+ 43	101	19 04
9	.1449	7.815	18 28 06	18.963	16 39 57	7.727	- 23	98	17 26
10	.1459	7.793	18 28 22	18.982	16 35 44	7.681	- 84	98	15 44
11	+0.1483	7.758	18 28 58	19.001	16 31 31	-7.633	-132	100	14 03
12	.1528	7.715	18 30 00	19.021	16 27 19	7.583	-158	104	12 24
13	.1596	7.670	18 31 32	19.040	16 23 08	7.530	-163	110	10 53
14	.1690	7.633	18 33 32	19.061	16 18 58	7.476	-143	116	9 32
15	.1806	7.608	18 35 56	19.083	16 14 49	7.419	-101	117	8 16
16	+0.1935	7.603	18 38 33	19.105	16 10 41	-7.360	- 46	111	7 02
17	.2069	7.617	18 41 08	19.125	16 06 33	7.298	+ 13	98	5 41
18	.2196	7.653	18 43 28	19.149	16 02 27	7.235	+ 64	79	3 53
19	.2304	7.702	18 45 19	19.171	15 58 22	7.170	+ 94	65	1 16
20	.2382	7.754	18 46 33	19.195	15 54 17	7.103	+ 95	70	22 08
21	+0.2430	7.797	18 47 13	19.219	15 50 14	-7.034	+ 64	91	19 49
22	.2452	7.817	18 47 31	19.245	15 46 12	6.963	+ 7	110	18 10
23	.2466	7.808	18 47 52	19.270	15 42 11	6.890	- 58	116	16 44
24	.2495	7.772	18 48 40	19.295	15 38 10	6.816	-111	109	15 13
25	.2553	7.719	18 50 10	19.322	15 34 11	6.739	-133	92	13 19
26	+0.2652	7.666	18 52 30	19.349	15 30 12	-6.661	-116	80	10 44
27	.2787	7.628	18 55 27	19.378	15 26 14	6.581	- 65	84	8 00
28	.2943	7.616	18 58 43	19.407	15 22 16	6.500	+ 7	100	5 50
29	.3101	7.629	19 01 49	19.436	15 18 19	6.417	+ 81	114	4 10
30	.3248	7.662	19 04 32	19.465	15 14 23	6.331	+142	123	2 45
May 1	+0.3371	7.706	19 06 38	19.495	15 10 27	-6.244	+179	125	1 25
2	.3468	7.751	19 08 10	19.525	15 06 32	6.155	+187	122	0 06
3	.3536	7.792	19 09 10	19.556	15 02 37	6.064	+168	116	22 42
4	.3583	7.822	19 09 51	19.586	14 58 42	5.972	+125	109	21 13
5	.3615	7.834	19 10 22	19.617	14 54 49	5.878	+ 67	104	19 40
6	+0.3640	7.832	19 10 53	19.646	14 50 56	-5.781	+ 2	99	18 03
7	.3669	7.813	19 11 39	19.676	14 47 03	5.683	- 61	96	16 22
8	.3709	7.783	19 12 46	19.705	14 43 13	5.584	-113	95	14 37
9	.3770	7.747	19 14 20	19.734	14 39 22	5.483	-146	97	12 52
10	.3854	7.712	19 16 25	19.763	14 35 32	5.380	-156	103	11 15
11	+0.3964	7.686	19 18 58	19.791	14 31 43	-5.275	-141	110	9 47
12	.4097	7.674	19 21 49	19.818	14 27 54	5.169	-104	113	8 26
13	.4247	7.684	19 24 51	19.845	14 24 06	5.061	- 51	110	7 10
14	.4402	7.713	19 27 44	19.871	14 20 20	4.953	+ 7	100	5 50
15	.4552	7.762	19 30 16	19.897	14 16 34	4.842	+ 59	84	4 12
16	+0.4685	7.822	19 32 17	19.922	14 12 49	-4.731	+ 92	69	1 58
17	+0.4791	7.885	19 33 41	19.947	14 09 05	-4.618	+ 98	66	23 01

BESSELIAN DAY NUMBERS, 1967

FOR 0^h EPHEMERIS TIME

Date	A	B	C	D	E	dψ	dε	τ	S.T.
					(0 ^s .0001)	(0 [″] .001)			^h
May 17	+ 3 [″] .134	-7 [″] .235	-10 [″] .650	-16 [″] .866	-16	+161	+ 17	+0.3722	15.6
18	3 [″] .185	7 [″] .271	10 [″] .388	17 [″] .057	16	+122	+ 65	.3750	15.7
19	3 [″] .218	7 [″] .294	10 [″] .123	17 [″] .243	16	+ 40	+100	.3777	15.7
20	3 [″] .243	7 [″] .294	9 [″] .856	17 [″] .424	16	- 65	+111	.3805	15.8
21	3 [″] .271	7 [″] .265	9 [″] .587	17 [″] .600	16	-164	+ 93	.3832	15.9
22	+ 3 [″] .314	-7 [″] .212	- 9 [″] .316	-17 [″] .771	-16	-225	+ 51	+0.3859	15.9
23	3 [″] .382	7 [″] .146	9 [″] .042	17 [″] .938	16	-227	- 4	.3887	16.0
24	3 [″] .474	7 [″] .083	8 [″] .766	18 [″] .099	16	-166	- 57	.3914	16.1
25	3 [″] .587	7 [″] .037	8 [″] .488	18 [″] .256	16	- 58	- 93	.3941	16.1
26	3 [″] .707	7 [″] .015	8 [″] .208	18 [″] .409	16	+ 70	-106	.3969	16.2
27	+ 3 [″] .823	-7 [″] .018	- 7 [″] .925	-18 [″] .556	-16	+186	- 93	+0.3996	16.3
28	3 [″] .926	7 [″] .042	7 [″] .640	18 [″] .699	15	+268	- 61	.4024	16.3
29	4 [″] .010	7 [″] .076	7 [″] .353	18 [″] .837	15	+303	- 18	.4051	16.4
30	4 [″] .076	7 [″] .112	7 [″] .064	18 [″] .970	15	+289	+ 26	.4078	16.5
31	4 [″] .125	7 [″] .143	6 [″] .772	19 [″] .098	15	+232	+ 64	.4106	16.5
June 1	+ 4 [″] .161	-7 [″] .162	- 6 [″] .479	-19 [″] .221	-15	+143	+ 90	+0.4133	16.6
2	4 [″] .192	7 [″] .164	6 [″] .183	19 [″] .338	15	+ 39	+ 99	.4161	16.7
3	4 [″] .222	7 [″] .151	5 [″] .885	19 [″] .450	16	- 67	+ 92	.4188	16.7
4	4 [″] .259	7 [″] .123	5 [″] .586	19 [″] .556	16	-157	+ 69	.4215	16.8
5	4 [″] .307	7 [″] .082	5 [″] .285	19 [″] .656	16	-221	+ 34	.4243	16.8
6	+ 4 [″] .369	-7 [″] .036	- 4 [″] .982	-19 [″] .751	-16	-248	- 8	+0.4270	16.9
7	4 [″] .449	6 [″] .990	4 [″] .678	19 [″] .840	15	-233	- 50	.4297	17.0
8	4 [″] .544	6 [″] .952	4 [″] .372	19 [″] .923	15	-179	- 84	.4325	17.0
9	4 [″] .652	6 [″] .930	4 [″] .065	20 [″] .000	15	- 95	-103	.4352	17.1
10	4 [″] .765	6 [″] .928	3 [″] .757	20 [″] .071	15	+ 2	-103	.4380	17.2
11	+ 4 [″] .876	-6 [″] .947	- 3 [″] .448	-20 [″] .136	-15	+ 93	- 82	+0.4407	17.2
12	4 [″] .976	6 [″] .983	3 [″] .138	20 [″] .195	15	+156	- 44	.4434	17.3
13	5 [″] .059	7 [″] .031	2 [″] .827	20 [″] .248	14	+177	+ 5	.4462	17.4
14	5 [″] .122	7 [″] .080	2 [″] .516	20 [″] .295	14	+148	+ 54	.4489	17.4
15	5 [″] .168	7 [″] .118	2 [″] .205	20 [″] .336	14	+ 74	+ 92	.4516	17.5
16	+ 5 [″] .203	-7 [″] .135	- 1 [″] .894	-20 [″] .371	-15	- 28	+108	+0.4544	17.6
17	5 [″] .237	7 [″] .128	1 [″] .583	20 [″] .401	15	-132	+ 99	.4571	17.6
18	5 [″] .282	7 [″] .096	1 [″] .271	20 [″] .425	15	-209	+ 65	.4599	17.7
19	5 [″] .347	7 [″] .048	0 [″] .960	20 [″] .444	15	-236	+ 15	.4626	17.8
20	5 [″] .436	6 [″] .998	0 [″] .649	20 [″] .458	14	-202	- 39	.4653	17.8
21	+ 5 [″] .547	-6 [″] .958	- 0 [″] .338	-20 [″] .466	-14	-114	- 82	+0.4681	17.9
22	5 [″] .670	6 [″] .941	- 0 [″] .027	20 [″] .469	14	+ 7	-104	.4708	18.0
23	5 [″] .795	6 [″] .949	+ 0 [″] .284	20 [″] .467	14	+130	-101	.4735	18.0
24	5 [″] .910	6 [″] .979	0 [″] .595	20 [″] .459	14	+229	- 76	.4763	18.1
25	6 [″] .008	7 [″] .026	0 [″] .906	20 [″] .446	13	+285	- 35	.4790	18.2
26	+ 6 [″] .086	-7 [″] .079	+ 1 [″] .217	-20 [″] .429	-13	+291	+ 11	+0.4818	18.2
27	6 [″] .145	7 [″] .128	1 [″] .528	20 [″] .405	13	+249	+ 52	.4845	18.3
28	6 [″] .189	7 [″] .166	1 [″] .839	20 [″] .376	13	+170	+ 83	.4872	18.4
29	6 [″] .224	7 [″] .190	2 [″] .149	20 [″] .342	13	+ 70	+ 98	.4900	18.4
30	6 [″] .257	7 [″] .197	2 [″] .459	20 [″] .302	13	- 37	+ 96	.4927	18.5
July 1	+ 6 [″] .293	-7 [″] .189	+ 2 [″] .769	-20 [″] .256	-14	-134	+ 78	+0.4955	18.6
2	+ 6 [″] .339	-7 [″] .166	+ 3 [″] .079	-20 [″] .204	-14	-207	+ 45	+0.4982	18.6

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
	^s	["]	^{h m s}	["]	^{h m s}	["]	(0 ^s .0001)	(0 ["] .001)	^{h m}
May 17	+0.4791	7.885	19 33 41	19.947	14 09 05	-4.618	+ 98	66	23 01
18	.4868	7.938	19 34 37	19.971	14 05 22	4.505	+ 75	81	20 27
19	.4920	7.972	19 35 13	19.995	14 01 40	4.390	+ 24	101	18 36
20	.4957	7.982	19 35 53	20.018	13 57 59	4.274	- 40	114	17 08
21	.5000	7.967	19 36 57	20.042	13 54 19	4.157	-100	114	15 40
22	+0.5066	7.937	19 38 43	20.065	13 50 39	-4.040	-138	103	13 59
23	.5170	7.906	19 41 18	20.088	13 47 00	3.921	-139	90	11 50
24	.5312	7.889	19 44 30	20.110	13 43 22	3.801	-102	87	9 17
25	.5484	7.898	19 48 02	20.133	13 39 44	3.681	- 35	96	6 56
26	.5669	7.934	19 51 25	20.156	13 36 07	3.559	+ 43	110	5 01
27	+0.5847	7.992	19 54 19	20.178	13 32 30	-3.437	+114	119	3 26
28	.6005	8.062	19 56 33	20.200	13 28 54	3.313	+164	123	1 59
29	.6135	8.133	19 58 10	20.221	13 25 18	3.189	+185	122	0 34
30	.6236	8.197	19 59 16	20.243	13 21 42	3.063	+177	118	23 09
31	.6310	8.249	20 00 01	20.263	13 18 06	2.937	+142	112	21 41
June 1	+0.6366	8.283	20 00 37	20.284	13 14 31	-2.810	+ 87	106	20 09
2	.6413	8.300	20 01 20	20.302	13 10 55	2.681	+ 24	100	18 36
3	.6460	8.304	20 02 14	20.321	13 07 20	2.552	- 41	96	16 56
4	.6517	8.299	20 03 30	20.338	13 03 46	2.422	- 96	93	15 12
5	.6589	8.289	20 05 13	20.354	13 00 12	2.292	-135	94	13 25
6	+0.6686	8.282	20 07 21	20.370	12 56 37	-2.160	-152	99	11 41
7	.6808	8.286	20 09 54	20.384	12 53 04	2.029	-143	105	10 07
8	.6954	8.305	20 12 41	20.397	12 49 31	1.896	-109	110	8 41
9	.7119	8.347	20 15 29	20.409	12 45 57	1.763	- 58	110	7 20
10	.7293	8.408	20 18 05	20.420	12 42 25	1.629	+ 1	103	5 58
11	+0.7463	8.487	20 20 15	20.429	12 38 52	-1.495	+ 57	90	4 23
12	.7616	8.575	20 21 53	20.437	12 35 20	1.361	+ 95	76	2 21
13	.7744	8.662	20 22 57	20.444	12 31 48	1.226	+108	71	23 44
14	.7841	8.739	20 23 32	20.450	12 28 16	1.091	+ 91	80	21 10
15	.7912	8.796	20 23 55	20.455	12 24 45	0.956	+ 45	97	19 11
16	+0.7965	8.831	20 24 24	20.459	12 21 15	-0.821	- 17	109	17 37
17	.8017	8.845	20 25 13	20.462	12 17 45	0.686	- 81	112	16 08
18	.8086	8.846	20 26 39	20.464	12 14 15	0.551	-128	105	14 32
19	.8186	8.847	20 28 44	20.466	12 10 45	0.416	-144	95	12 36
20	.8322	8.861	20 31 21	20.468	12 07 16	0.281	-124	89	10 16
21	+0.8492	8.898	20 34 15	20.469	12 03 47	-0.147	- 70	94	7 56
22	.8682	8.962	20 36 59	20.469	12 00 18	-0.012	+ 4	104	5 54
23	.8874	9.048	20 39 18	20.469	11 56 49	+0.123	+ 80	113	4 12
24	.9051	9.145	20 41 02	20.468	11 53 20	0.258	+140	119	2 39
25	.9201	9.245	20 42 08	20.466	11 49 51	0.393	+174	119	1 09
26	+0.9320	9.335	20 42 45	20.465	11 46 22	+0.528	+178	116	23 38
27	.9411	9.411	20 43 03	20.462	11 42 52	0.663	+152	112	22 09
28	.9478	9.469	20 43 16	20.459	11 39 22	0.797	+104	107	20 37
29	.9532	9.510	20 43 31	20.455	11 35 53	0.932	+ 43	102	19 03
30	.9582	9.537	20 44 01	20.450	11 32 23	1.066	- 23	97	17 25
July 1	+0.9638	9.554	20 44 47	20.445	11 28 52	+1.201	- 82	94	15 43
2	+0.9708	9.567	20 45 59	20.437	11 25 20	+1.335	-127	94	13 55

BESSELIAN DAY NUMBERS, 1967
FOR 0^h EPHEMERIS TIME

Date	A	B	C	D	E	dψ	dε	τ	S.T.
					(0 ^s .0001)		(0 [″] .001)		^h
July 1	-13.748	-7.189	+ 2.774	-20.255	-14	-134	+ 78	-0.5045	18.6
2	13.702	7.166	3.084	20.203	14	-207	+ 45	.5018	18.6
3	13.642	7.137	3.393	20.146	14	-244	+ 5	.4991	18.7
4	13.567	7.105	3.701	20.083	13	-242	- 38	.4963	18.8
5	13.476	7.080	4.008	20.014	13	-199	- 75	.4936	18.8
6	-13.371	-7.068	+ 4.315	-19.939	-13	-121	- 99	-0.4909	18.9
7	13.258	7.074	4.620	19.858	13	- 23	-106	.4881	19.0
8	13.145	7.104	4.924	19.771	13	+ 76	- 90	.4854	19.0
9	13.041	7.153	5.226	19.679	13	+153	- 55	.4826	19.1
10	12.954	7.216	5.527	19.580	12	+189	- 6	.4799	19.1
11	-12.887	-7.282	+ 5.825	-19.476	-12	+173	+ 45	-0.4772	19.2
12	12.840	7.338	6.122	19.365	12	+109	+ 86	.4744	19.3
13	12.807	7.375	6.417	19.250	12	+ 11	+107	.4717	19.3
14	12.778	7.387	6.710	19.129	13	- 95	+103	.4690	19.4
15	12.741	7.375	7.000	19.003	13	-181	+ 74	.4662	19.5
16	-12.687	-7.347	+ 7.288	-18.872	-13	-222	+ 29	-0.4635	19.5
17	12.610	7.312	7.574	18.736	13	-208	- 24	.4607	19.6
18	12.513	7.284	7.858	18.595	12	-140	- 70	.4580	19.7
19	12.401	7.273	8.139	18.449	12	- 34	- 99	.4553	19.7
20	12.284	7.286	8.418	18.299	12	+ 86	-105	.4525	19.8
21	-12.173	-7.324	+ 8.695	-18.144	-12	+192	- 86	-0.4498	19.9
22	12.077	7.378	8.970	17.984	12	+263	- 51	.4471	19.9
23	11.999	7.444	9.242	17.820	12	+287	- 5	.4443	20.0
24	11.942	7.508	9.512	17.651	12	+261	+ 39	.4416	20.1
25	11.902	7.563	9.780	17.477	12	+193	+ 74	.4388	20.1
26	-11.873	-7.605	+10.046	-17.299	-12	+ 98	+ 95	-0.4361	20.2
27	11.850	7.630	10.309	17.115	12	- 9	+ 99	.4334	20.3
28	11.824	7.637	10.570	16.927	12	-110	+ 85	.4306	20.3
29	11.792	7.629	10.828	16.734	12	-192	+ 56	.4279	20.4
30	11.747	7.612	11.083	16.536	12	-242	+ 18	.4252	20.5
31	-11.688	-7.591	+11.336	-16.333	-12	-254	- 25	-0.4224	20.5
Aug. 1	11.613	7.574	11.586	16.126	12	-225	- 64	.4197	20.6
2	11.523	7.567	11.833	15.913	12	-159	- 93	.4169	20.7
3	11.424	7.576	12.076	15.696	12	- 66	-106	.4142	20.7
4	11.321	7.606	12.316	15.474	11	+ 36	- 98	.4115	20.8
5	-11.224	-7.657	+12.553	-15.247	-11	+126	- 69	-0.4087	20.9
6	11.141	7.725	12.787	15.015	11	+182	- 23	.4060	20.9
7	11.079	7.801	13.016	14.779	11	+187	+ 30	.4032	21.0
8	11.039	7.871	13.242	14.538	11	+137	+ 78	.4005	21.1
9	11.016	7.922	13.463	14.293	11	+ 47	+106	.3978	21.1
10	-10.999	-7.947	+13.680	-14.043	-11	- 60	+109	-0.3950	21.2
11	10.978	7.945	13.893	13.790	12	-152	+ 85	.3923	21.3
12	10.941	7.923	14.102	13.533	12	-205	+ 41	.3896	21.3
13	10.884	7.893	14.307	13.272	12	-203	- 12	.3868	21.4
14	10.805	7.867	14.507	13.008	12	-146	- 60	.3841	21.4
15	-10.710	-7.856	+14.704	-12.741	-11	- 50	- 93	-0.3813	21.5
16	-10.609	-7.867	+14.896	-12.470	-11	+ 64	-104	-0.3786	21.6

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
							(0 ⁸ .0001)	(0 ⁸ .001)	
			^{h m s}	^{h m s}	^{h m s}	^{h m s}			^{h m}
July 1	-2.1098	15.514	13 50 25	20.444	11 28 48	+1.203	- 82	94	15 43
2	.1028	15.463	13 50 26	20.437	11 25 17	1.337	-127	94	13 55
3	.0936	15.396	13 50 28	20.430	11 21 46	1.471	-149	97	12 12
4	.0821	15.315	13 50 34	20.421	11 18 14	1.605	-148	103	10 34
5	.0680	15.223	13 50 52	20.411	11 14 42	1.738	-122	109	9 06
6	-2.0519	15.124	13 51 27	20.401	11 11 09	+1.871	- 74	110	7 44
7	.0346	15.027	13 52 20	20.388	11 07 37	2.003	- 14	106	6 20
8	.0173	14.942	13 53 33	20.375	11 04 04	2.135	+ 46	95	4 46
9	2.0013	14.874	13 54 59	20.361	11 00 31	2.266	+ 94	82	2 49
10	1.9879	14.828	13 56 29	20.345	10 56 57	2.397	+116	75	0 18
11	-1.9777	14.802	13 57 53	20.328	10 53 24	+2.526	+106	82	21 47
12	.9705	14.789	13 59 00	20.310	10 49 50	2.655	+ 67	96	19 47
13	.9655	14.779	13 59 45	20.291	10 46 16	2.783	+ 7	107	18 09
14	.9610	14.759	14 00 08	20.272	10 42 41	2.910	- 58	110	16 40
15	.9553	14.721	14 00 15	20.251	10 39 07	3.035	-111	103	15 03
16	-1.9470	14.661	14 00 18	20.230	10 35 32	+3.160	-136	93	13 13
17	.9352	14.577	14 00 26	20.209	10 31 58	3.284	-127	86	10 55
18	.9203	14.479	14 00 49	20.187	10 28 22	3.408	- 86	89	8 34
19	.9032	14.376	14 01 34	20.165	10 24 47	3.529	- 21	100	6 31
20	.8852	14.282	14 02 41	20.142	10 21 11	3.650	+ 53	110	4 48
21	-1.8681	14.206	14 04 08	20.120	10 17 35	+3.770	+117	115	3 14
22	.8533	14.152	14 05 41	20.097	10 13 58	3.890	+161	116	1 44
23	.8414	14.121	14 07 16	20.074	10 10 21	4.008	+176	114	0 10
24	.8326	14.106	14 08 38	20.051	10 06 43	4.125	+160	111	22 38
25	.8265	14.102	14 09 44	20.027	10 03 05	4.241	+118	107	21 04
26	-1.8221	14.100	14 10 34	20.004	9 59 25	+4.356	+ 60	103	19 29
27	.8185	14.094	14 11 06	19.980	9 55 45	4.470	- 6	99	17 52
28	.8146	14.076	14 11 26	19.956	9 52 04	4.584	- 67	96	16 11
29	.8097	14.045	14 11 36	19.932	9 48 23	4.695	-117	95	14 25
30	.8028	13.998	14 11 46	19.907	9 44 41	4.806	-148	98	12 42
31	-1.7937	13.937	14 12 01	19.881	9 40 57	+4.916	-155	104	11 04
Aug. 1	.7822	13.865	14 12 27	19.857	9 37 13	5.024	-138	110	9 38
2	.7685	13.786	14 13 10	19.830	9 33 28	5.131	- 97	113	8 17
3	.7532	13.708	14 14 12	19.804	9 29 42	5.237	- 40	109	6 56
4	.7375	13.639	14 15 35	19.777	9 25 56	5.341	+ 22	99	5 27
5	-1.7226	13.587	14 17 12	19.750	9 22 08	+5.443	+ 77	85	3 36
6	.7098	13.557	14 18 57	19.722	9 18 20	5.545	+111	76	1 11
7	.7002	13.550	14 20 36	19.693	9 14 31	5.644	+114	80	22 32
8	.6941	13.558	14 21 57	19.665	9 10 41	5.742	+ 84	95	20 20
9	.6906	13.569	14 22 53	19.635	9 06 51	5.838	+ 29	108	18 40
10	-1.6881	13.570	14 23 24	19.605	9 03 00	+5.932	- 37	112	17 11
11	.6848	13.551	14 23 34	19.575	8 59 09	6.025	- 93	104	15 38
12	.6792	13.509	14 23 38	19.545	8 55 17	6.115	-125	91	13 47
13	.6704	13.445	14 23 48	19.515	8 51 24	6.204	-124	82	11 26
14	.6582	13.366	14 24 14	19.485	8 47 31	6.291	- 89	83	8 56
15	-1.6437	13.282	14 25 02	19.456	8 43 38	+6.376	- 31	95	6 48
16	-1.6282	13.208	14 26 14	19.427	8 39 44	+6.459	+ 39	107	5 05

BESSELIAN DAY NUMBERS, 1967
FOR 0^h EPHEMERIS TIME

Date	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>dψ</i>	<i>dε</i>	<i>τ</i>	S.T.
					(0 ^s .0001)	(0 [″] .001)			^h
Aug. 16	-10.609	-7.867	+14.896	-12.470	-11	+ 64	-104	-0.3786	21.6
17	10.511	7.899	15.084	12.196	11	+172	- 93	.3759	21.6
18	10.426	7.952	15.268	11.919	11	+250	- 62	.3731	21.7
19	10.358	8.016	15.448	11.639	11	+285	- 19	.3704	21.8
20	10.310	8.083	15.624	11.356	11	+273	+ 27	.3677	21.8
21	-10.279	-8.142	+15.796	-11.070	-11	+217	+ 65	-0.3649	21.9
22	10.262	8.189	15.964	10.780	11	+128	+ 91	.3622	22.0
23	10.252	8.218	16.128	10.488	11	+ 23	+100	.3594	22.0
24	10.243	8.230	16.288	10.192	12	- 82	+ 92	.3567	22.1
25	10.228	8.225	16.443	9.894	12	-172	+ 67	.3540	22.2
26	-10.202	-8.208	+16.595	- 9.592	-12	-234	+ 31	-0.3512	22.2
27	10.162	8.185	16.742	9.287	12	-259	- 11	.3485	22.3
28	10.106	8.163	16.884	8.979	12	-245	- 52	.3458	22.4
29	10.037	8.148	17.022	8.668	12	-193	- 85	.3430	22.4
30	9.956	8.147	17.155	8.354	12	-112	-104	.3403	22.5
31	- 9.869	-8.165	+17.283	- 8.038	-12	- 15	-104	-0.3375	22.6
Sept. 1	9.783	8.203	17.407	7.718	11	+ 80	- 83	.3348	22.6
2	9.708	8.259	17.525	7.396	11	+151	- 43	.3321	22.7
3	9.649	8.329	17.638	7.071	11	+179	+ 10	.3293	22.8
4	9.614	8.396	17.746	6.743	11	+151	+ 62	.3266	22.8
5	- 9.597	-8.450	+17.848	- 6.414	-12	+ 75	+101	-0.3238	22.9
6	9.593	8.478	17.945	6.082	12	- 29	+114	.3211	23.0
7	9.587	8.476	18.037	5.748	12	-130	+ 98	.3184	23.0
8	9.568	8.449	18.123	5.413	12	-195	+ 57	.3156	23.1
9	9.526	8.408	18.203	5.076	12	-205	+ 3	.3129	23.2
10	- 9.462	-8.368	+18.278	- 4.738	-12	-156	- 50	-0.3102	23.2
11	9.380	8.342	18.347	4.398	12	- 63	- 88	.3074	23.3
12	9.290	8.337	18.411	4.058	12	+ 53	-104	.3047	23.4
13	9.202	8.355	18.470	3.717	12	+163	- 97	.3019	23.4
14	9.123	8.392	18.524	3.375	12	+249	- 70	.2992	23.5
15	- 9.062	-8.442	+18.572	- 3.032	-12	+293	- 30	-0.2965	23.6
16	9.019	8.497	18.616	2.688	12	+291	+ 16	.2937	23.6
17	8.995	8.547	18.654	2.344	12	+244	+ 57	.2910	23.7
18	8.984	8.585	18.687	1.999	12	+162	+ 87	.2883	23.7
19	8.982	8.606	18.716	1.654	12	+ 59	+101	.2855	23.8
20	- 8.981	-8.609	+18.739	- 1.307	-12	- 48	+ 97	-0.2828	23.9
21	8.976	8.594	18.757	0.960	13	-144	+ 76	.2800	23.9
22	8.961	8.566	18.770	0.613	13	-215	+ 43	.2773	0.0
23	8.933	8.530	18.778	- 0.265	13	-253	+ 2	.2746	0.1
24	8.890	8.493	18.780	+ 0.084	13	-252	- 39	.2718	0.1
25	- 8.831	-8.460	+18.778	+ 0.433	-13	-214	- 75	-0.2691	0.2
26	8.761	8.439	18.770	0.783	13	-145	- 99	.2664	0.3
27	8.683	8.435	18.756	1.133	13	- 57	-105	.2636	0.3
28	8.603	8.449	18.737	1.483	13	+ 35	- 93	.2609	0.4
29	8.529	8.483	18.712	1.834	12	+112	- 60	.2581	0.5
30	- 8.468	-8.530	+18.682	+ 2.184	-12	+156	- 13	-0.2554	0.5
Oct. 1	- 8.427	-8.582	+18.646	+ 2.534	-13	+149	+ 40	-0.2527	0.6

INDEPENDENT DAY NUMBERS, 1967

269

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
	^s	["]	^{h m s}	["]	^{h m s}	["]	(0 ^s .0001)	(0 ["] .001)	^{h m}
Aug. 16	-1.6282	13.208	14 26 14	19.427	8 39 44	+6.459	+ 39	107	5 05
17	.6132	13.148	14 27 42	19.398	8 35 50	6.541	+105	115	3 35
18	.6001	13.112	14 29 20	19.369	8 31 55	6.621	+153	117	2 08
19	.5897	13.097	14 30 57	19.342	8 27 59	6.699	+174	115	0 38
20	.5823	13.101	14 32 23	19.315	8 24 02	6.775	+167	112	23 04
21	-1.5776	13.113	14 33 32	19.289	8 20 06	+6.850	+133	108	21 32
22	.5750	13.129	14 34 21	19.263	8 16 07	6.923	+ 78	104	19 57
23	.5735	13.139	14 34 52	19.238	8 12 09	6.994	+ 14	100	18 21
24	.5720	13.140	14 35 07	19.214	8 08 08	7.063	- 50	98	16 42
25	.5697	13.125	14 35 13	19.190	8 04 09	7.130	-105	96	14 58
26	-1.5658	13.094	14 35 16	19.168	8 00 07	+7.196	-143	98	13 14
27	.5596	13.048	14 35 24	19.145	7 56 04	7.260	-158	104	11 36
28	.5512	12.991	14 35 43	19.123	7 52 01	7.322	-150	110	10 08
29	.5405	12.928	14 36 17	19.102	7 47 57	7.381	-118	114	8 48
30	.5280	12.865	14 37 11	19.081	7 43 51	7.439	- 69	113	7 33
31	-1.5147	12.809	14 38 25	19.061	7 39 46	+7.495	- 9	104	6 13
Sept. 1	.5016	12.767	14 39 55	19.041	7 35 39	7.548	+ 49	89	4 36
2	.4899	12.746	14 41 33	19.022	7 31 31	7.600	+ 92	74	2 23
3	.4810	12.747	14 43 12	19.003	7 27 23	7.649	+109	72	23 28
4	.4756	12.764	14 44 31	18.984	7 23 13	7.695	+ 92	86	20 56
5	-1.4731	12.787	14 45 27	18.965	7 19 04	+7.740	+ 46	105	19 06
6	.4724	12.802	14 45 52	18.948	7 14 53	7.782	- 18	115	17 37
7	.4715	12.797	14 45 55	18.931	7 10 42	7.822	- 80	111	16 09
8	.4686	12.764	14 45 47	18.914	7 06 31	7.859	-119	96	14 25
9	.4622	12.706	14 45 44	18.898	7 02 20	7.894	-125	82	12 08
10	-1.4523	12.631	14 45 57	18.882	6 58 08	+7.926	- 95	80	9 24
11	.4398	12.553	14 46 35	18.867	6 53 55	7.956	- 39	91	7 03
12	.4259	12.482	14 47 37	18.853	6 49 43	7.984	+ 32	106	5 14
13	.4124	12.429	14 48 57	18.840	6 45 31	8.009	+100	117	3 45
14	.4004	12.396	14 50 26	18.829	6 41 18	8.033	+152	121	2 21
15	-1.3910	12.385	14 51 53	18.818	6 37 05	+8.054	+179	120	0 58
16	.3844	12.391	14 53 10	18.809	6 32 52	8.073	+178	117	23 29
17	.3806	12.408	14 54 09	18.801	6 28 39	8.089	+149	113	21 58
18	.3790	12.426	14 54 48	18.794	6 24 25	8.103	+ 99	108	20 26
19	.3787	12.439	14 55 06	18.789	6 20 12	8.116	+ 36	104	18 52
20	-1.3786	12.441	14 55 09	18.784	6 15 57	+8.126	- 29	99	17 16
21	.3779	12.427	14 55 01	18.781	6 11 43	8.134	- 88	95	15 32
22	.3756	12.397	14 54 50	18.780	6 07 29	8.139	-132	96	13 47
23	.3713	12.351	14 54 43	18.780	6 03 14	8.143	-155	101	12 05
24	.3647	12.295	14 54 46	18.780	5 58 59	8.144	-154	108	10 35
25	-1.3557	12.229	14 55 05	18.783	5 54 43	+8.143	-131	114	9 14
26	.3449	12.164	14 55 43	18.786	5 50 27	8.139	- 89	115	8 01
27	.3329	12.106	14 56 41	18.790	5 46 10	8.133	- 35	107	6 49
28	.3207	12.058	14 57 56	18.796	5 41 54	8.125	+ 21	94	5 26
29	.3093	12.029	14 59 23	18.802	5 37 37	8.114	+ 69	75	3 34
30	-1.3000	12.019	15 00 50	18.809	5 33 20	+8.101	+ 95	63	0 47
Oct. 1	-1.2937	12.028	15 02 05	18.818	5 29 03	+8.086	+ 91	71	21 44

BESSELIAN DAY NUMBERS, 1967

FOR 0^h EPHEMERIS TIME

Date	A	B	C	D	E	dψ	dε	τ	S.T.
					(0 ^s .0001)	(0 ^s .001)			^h
Oct. 1	- 8.427	-8.582	+18.646	+ 2.534	-13	+149	+ 40	-0.2527	0.6
2	8.406	8.628	18.604	2.884	13	+ 92	+ 87	.2499	0.7
3	8.401	8.653	18.556	3.234	13	- 4	+113	.2472	0.7
4	8.399	8.646	18.501	3.583	13	-111	+109	.2444	0.8
5	8.388	8.611	18.441	3.931	13	-194	+ 77	.2417	0.9
6	- 8.355	-8.555	+18.376	+ 4.278	-13	-223	+ 24	-0.2390	0.9
7	8.297	8.493	18.304	4.623	13	-189	- 34	.2362	1.0
8	8.216	8.442	18.227	4.966	13	- 98	- 80	.2335	1.1
9	8.122	8.412	18.143	5.308	13	+ 24	-105	.2308	1.1
10	8.027	8.408	18.055	5.648	13	+147	-103	.2280	1.2
11	- 7.942	-8.425	+17.961	+ 5.986	-13	+246	- 80	-0.2253	1.3
12	7.873	8.458	17.862	6.322	13	+303	- 40	.2225	1.3
13	7.823	8.495	17.758	6.656	13	+312	+ 5	.2198	1.4
14	7.790	8.530	17.649	6.988	13	+275	+ 48	.2171	1.5
15	7.773	8.554	17.535	7.318	13	+200	+ 81	.2143	1.5
16	- 7.765	-8.563	+17.416	+ 7.646	-13	+100	+ 99	-0.2116	1.6
17	7.760	8.555	17.292	7.972	13	- 8	+100	.2089	1.7
18	7.750	8.529	17.163	8.296	13	-108	+ 84	.2061	1.7
19	7.733	8.487	17.029	8.617	14	-187	+ 53	.2034	1.8
20	7.702	8.437	16.890	8.936	14	-234	+ 14	.2006	1.9
21	- 7.656	-8.384	+16.747	+ 9.253	-14	-245	- 28	-0.1979	1.9
22	7.594	8.334	16.598	9.568	14	-217	- 66	.1952	2.0
23	7.520	8.295	16.444	9.880	14	-159	- 93	.1924	2.0
24	7.437	8.271	16.286	10.190	14	- 79	-104	.1897	2.1
25	7.350	8.265	16.122	10.498	13	+ 8	- 97	.1870	2.2
26	- 7.266	-8.277	+15.954	+10.802	-13	+ 85	- 72	-0.1842	2.2
27	7.193	8.306	15.780	11.104	13	+135	- 30	.1815	2.3
28	7.136	8.342	15.601	11.403	13	+143	+ 20	.1787	2.4
29	7.098	8.377	15.417	11.699	13	+102	+ 69	.1760	2.4
30	7.076	8.396	15.228	11.992	13	+ 19	+103	.1733	2.5
31	- 7.063	-8.392	+15.033	+12.281	-14	- 88	+113	-0.1705	2.6
Nov. 1	7.046	8.357	14.834	12.567	14	-187	+ 93	.1678	2.6
2	7.011	8.297	14.629	12.849	14	-243	+ 48	.1650	2.7
3	6.950	8.223	14.420	13.127	14	-234	- 11	.1623	2.8
4	6.863	8.154	14.205	13.400	14	-160	- 65	.1596	2.8
5	- 6.756	-8.102	+13.986	+13.670	-13	- 38	-101	-0.1568	2.9
6	6.641	8.079	13.763	13.935	13	+ 99	-109	.1541	3.0
7	6.533	8.080	13.535	14.195	13	+220	- 92	.1514	3.0
8	6.442	8.102	13.304	14.450	13	+298	- 55	.1486	3.1
9	6.369	8.133	13.068	14.701	13	+326	- 8	.1459	3.2
10	- 6.317	-8.162	+12.828	+14.947	-13	+302	+ 37	-0.1431	3.2
11	6.281	8.184	12.585	15.188	13	+236	+ 74	.1404	3.3
12	6.255	8.190	12.338	15.425	13	+141	+ 96	.1377	3.4
13	6.234	8.180	12.088	15.657	13	+ 34	+101	.1349	3.4
14	6.211	8.153	11.834	15.884	13	- 70	+ 89	.1322	3.5
15	- 6.180	-8.111	+11.577	+16.107	-13	-156	+ 63	-0.1295	3.6
16	- 6.136	-8.058	+11.316	+16.325	-13	-211	+ 25	-0.1267	3.6

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
	^s	["]	^{h m s}	["]	^{h m s}	["]	(0 ^s .0001)	(0 ["] .001)	^{h m}
Oct. 1	-1.2937	12.028	15 02 05	18.818	5 29 03	+8.086	+ 91	71	21 44
2	.2905	12.046	15 02 59	18.826	5 24 45	8.067	+ 56	94	19 31
3	.2897	12.060	15 03 23	18.836	5 20 27	8.047	- 2	113	17 57
4	.2895	12.054	15 03 19	18.845	5 16 09	8.023	- 68	118	16 32
5	.2878	12.021	15 03 01	18.856	5 11 52	7.997	-119	109	15 00
6	-1.2827	11.958	15 02 43	18.867	5 07 35	+7.969	-136	92	13 01
7	.2738	11.873	15 02 41	18.879	5 03 18	7.937	-116	82	10 23
8	.2613	11.780	15 03 07	18.891	4 59 02	7.904	- 60	89	7 44
9	.2469	11.693	15 04 01	18.904	4 54 46	7.868	+ 15	105	5 39
10	.2324	11.624	15 05 19	18.918	4 50 31	7.829	+ 90	118	4 02
11	-1.2193	11.578	15 06 46	18.932	4 46 16	+7.789	+150	126	2 37
12	.2087	11.555	15 08 13	18.948	4 42 02	7.746	+185	127	1 13
13	.2010	11.548	15 09 26	18.964	4 37 49	7.701	+191	124	23 51
14	.1961	11.552	15 10 23	18.982	4 33 36	7.653	+168	120	22 25
15	.1933	11.558	15 10 57	19.001	4 29 24	7.604	+122	114	20 58
16	-1.1921	11.559	15 11 12	19.021	4 25 11	+7.552	+ 61	107	19 27
17	.1914	11.550	15 11 10	19.041	4 21 00	7.498	- 5	100	17 53
18	.1900	11.524	15 10 58	19.063	4 16 49	7.443	- 66	94	16 12
19	.1873	11.482	15 10 39	19.085	4 12 39	7.384	-114	91	14 22
20	.1826	11.424	15 10 26	19.108	4 08 28	7.324	-143	94	12 34
21	-1.1756	11.354	15 10 24	19.133	4 04 19	+7.262	-150	101	10 56
22	.1661	11.275	15 10 39	19.158	4 00 09	7.198	-133	109	9 30
23	.1547	11.196	15 11 14	19.184	3 56 00	7.131	- 97	113	8 17
24	.1419	11.123	15 12 10	19.211	3 51 52	7.062	- 48	109	7 07
25	.1285	11.060	15 13 25	19.239	3 47 43	6.991	+ 5	97	5 53
26	-1.1158	11.014	15 14 53	19.267	3 43 36	+6.918	+ 52	80	4 19
27	.1045	10.988	15 16 26	19.295	3 39 28	6.843	+ 83	62	1 57
28	.0957	10.978	15 17 49	19.324	3 35 21	6.765	+ 87	60	22 42
29	.0899	10.980	15 18 54	19.353	3 31 14	6.685	+ 62	80	20 02
30	.0865	10.980	15 19 30	19.383	3 27 07	6.603	+ 12	103	18 17
31	-1.0846	10.969	15 19 40	19.412	3 23 01	+6.519	- 54	118	16 51
Nov. 1	.0820	10.931	15 19 28	19.442	3 18 55	6.433	-114	119	15 26
2	.0767	10.863	15 19 13	19.470	3 14 50	6.344	-149	108	13 46
3	.0673	10.767	15 19 11	19.500	3 10 45	6.253	-143	94	11 33
4	.0538	10.658	15 19 39	19.528	3 06 41	6.160	- 98	91	8 58
5	-1.0374	10.549	15 20 42	19.557	3 02 37	+6.065	- 23	102	6 34
6	.0199	10.458	15 22 19	19.586	2 58 35	5.968	+ 61	116	4 41
7	1.0033	10.391	15 24 10	19.614	2 54 33	5.869	+135	127	3 06
8	0.9892	10.351	15 26 03	19.642	2 50 32	5.769	+182	131	1 40
9	.9781	10.330	15 27 44	19.669	2 46 32	5.667	+199	130	0 14
10	-0.9701	10.321	15 29 03	19.697	2 42 33	+5.563	+185	126	22 52
11	.9645	10.316	15 29 59	19.725	2 38 35	5.457	+144	119	21 27
12	.9606	10.305	15 30 31	19.752	2 34 37	5.350	+ 86	111	20 01
13	.9574	10.285	15 30 46	19.780	2 30 41	5.242	+ 21	102	18 30
14	.9538	10.249	15 30 48	19.808	2 26 45	5.132	- 43	93	16 51
15	-0.9492	10.197	15 30 47	19.836	2 22 50	+5.020	- 95	88	15 02
16	-0.9424	10.128	15 30 51	19.863	2 18 55	+4.907	-129	88	13 06

FOR 0^h EPHEMERIS TIME

Date	A	B	C	D	E	dψ	dε	τ	S.T.
					(0 ^s .0001)	(0 [″] .001)			^h
Nov. 16	- 6.136	-8.058	+11.316	+16.325	-13	-211	+ 25	-0.1267	3.6
17	6.078	8.001	11.052	16.538	13	-231	- 17	.1240	3.7
18	6.003	7.948	10.784	16.747	13	-212	- 56	.1212	3.8
19	5.915	7.902	10.514	16.950	13	-160	- 87	.1185	3.8
20	5.817	7.873	10.239	17.149	13	- 84	-102	.1158	3.9
21	- 5.715	-7.861	+ 9.962	+17.343	-13	0	-100	-0.1130	4.0
22	5.614	7.868	9.681	17.532	13	+ 78	- 79	.1103	4.0
23	5.523	7.892	9.397	17.717	13	+131	- 42	.1076	4.1
24	5.446	7.926	9.110	17.896	12	+147	+ 5	.1048	4.2
25	5.387	7.961	8.820	18.070	12	+117	+ 53	.1021	4.2
26	- 5.345	-7.987	+ 8.526	+18.238	-12	+ 44	+ 91	-0.0993	4.3
27	5.313	7.994	8.229	18.401	13	- 57	+110	.0966	4.3
28	5.282	7.973	7.929	18.558	13	-163	+101	.0939	4.4
29	5.241	7.928	7.626	18.710	13	-243	+ 67	.0911	4.5
30	5.177	7.864	7.320	18.856	13	-266	+ 13	.0884	4.5
Dec. 1	- 5.085	-7.797	+ 7.012	+18.995	-13	-222	- 44	-0.0856	4.6
2	4.969	7.742	6.701	19.128	12	-117	- 89	.0829	4.7
3	4.838	7.711	6.388	19.254	12	+ 22	-111	.0802	4.7
4	4.708	7.710	6.072	19.374	12	+160	-103	.0774	4.8
5	4.591	7.733	5.755	19.488	12	+265	- 72	.0747	4.9
6	- 4.493	-7.771	+ 5.436	+19.595	-11	+318	- 26	-0.0720	4.9
7	4.418	7.812	5.116	19.695	11	+316	+ 22	.0692	5.0
8	4.361	7.848	4.794	19.790	11	+264	+ 64	.0665	5.1
9	4.319	7.869	4.471	19.877	11	+177	+ 91	.0637	5.1
10	4.283	7.875	4.146	19.959	11	+ 72	+102	.0610	5.2
11	- 4.247	-7.862	+ 3.821	+20.034	-11	- 34	+ 94	-0.0583	5.3
12	4.205	7.835	3.495	20.103	12	-125	+ 71	.0555	5.3
13	4.153	7.797	3.167	20.166	12	-190	+ 36	.0528	5.4
14	4.086	7.753	2.839	20.223	11	-219	- 5	.0501	5.5
15	4.003	7.710	2.511	20.273	11	-209	- 46	.0473	5.5
16	- 3.906	-7.675	+ 2.181	+20.318	-11	-164	- 80	-0.0446	5.6
17	3.799	7.655	1.851	20.357	11	- 92	- 99	.0418	5.7
18	3.685	7.652	1.520	20.389	11	- 5	-102	.0391	5.7
19	3.572	7.670	1.189	20.416	11	+ 78	- 85	.0364	5.8
20	3.469	7.705	0.857	20.437	10	+138	- 51	.0336	5.9
21	- 3.380	-7.753	+ 0.525	+20.451	-10	+162	- 6	-0.0309	5.9
22	3.309	7.803	+ 0.192	20.460	10	+142	+ 42	.0282	6.0
23	3.254	7.847	- 0.141	20.462	10	+ 78	+ 82	.0254	6.1
24	3.213	7.874	0.475	20.458	10	- 19	+105	.0227	6.1
25	3.177	7.878	0.808	20.447	10	-126	+104	.0199	6.2
26	- 3.134	-7.859	- 1.142	+20.430	-10	-218	+ 79	-0.0172	6.3
27	3.073	7.818	1.476	20.406	10	-266	+ 32	.0145	6.3
28	2.989	7.770	1.810	20.375	10	-254	- 23	.0117	6.4
29	2.880	7.726	2.144	20.338	10	-177	- 74	.0090	6.5
30	2.751	7.704	2.478	20.294	10	- 54	-105	.0063	6.5
31	- 2.617	-7.708	- 2.810	+20.243	- 9	+ 85	-110	-0.0035	6.6
32	- 2.489	-7.739	- 3.141	+20.185	- 9	+209	- 88	-0.0008	6.6

INDEPENDENT DAY NUMBERS, 1967

273

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
	^s	["]	^{h m s}	["]	^{h m s}	["]	(0 ^s .0001)	(0 ["] .001)	^{h m}
Nov. 16	-0.9424	10.128	15 30 51	19.863	2 18 55	+4.907	-129	88	13 06
17	.9335	10.048	15 31 07	19.891	2 15 01	4.793	-141	93	11 18
18	.9220	9.960	15 31 45	19.919	2 11 07	4.676	-130	101	9 46
19	.9085	9.871	15 32 44	19.946	2 07 15	4.559	- 98	108	8 25
20	.8934	9.789	15 34 10	19.973	2 03 22	4.440	- 51	107	7 13
21	-0.8777	9.719	15 35 56	20.001	1 59 30	+4.320	0	100	6 00
22	.8623	9.666	15 37 58	20.027	1 55 38	4.198	+ 48	85	4 34
23	.8483	9.633	15 40 04	20.055	1 51 46	4.075	+ 80	67	2 35
24	.8365	9.617	15 42 02	20.081	1 47 55	3.950	+ 90	59	23 40
25	.8275	9.612	15 43 40	20.108	1 44 04	3.825	+ 72	70	20 45
26	-0.8209	9.610	15 44 50	20.133	1 40 13	+3.697	+ 27	93	18 44
27	.8161	9.599	15 45 34	20.157	1 36 23	3.568	- 35	112	17 14
28	.8114	9.564	15 45 54	20.181	1 32 32	3.438	-100	120	15 49
29	.8051	9.504	15 46 08	20.205	1 28 42	3.307	-149	118	14 19
30	.7952	9.415	15 46 34	20.227	1 24 52	3.174	-163	107	12 28
Dec. 1	-0.7811	9.309	15 47 33	20.248	1 21 03	+3.041	-136	99	10 14
2	.7632	9.199	15 49 14	20.268	1 17 14	2.906	- 72	100	7 50
3	.7433	9.103	15 51 35	20.286	1 13 25	2.770	+ 13	111	5 42
4	.7232	9.034	15 54 22	20.303	1 09 36	2.633	+ 98	121	3 53
5	.7052	8.993	15 57 13	20.320	1 05 48	2.496	+162	128	2 17
6	-0.6902	8.976	15 59 51	20.335	1 02 01	+2.357	+194	129	0 46
7	.6786	8.975	16 02 03	20.348	0 58 15	2.218	+193	128	23 20
8	.6700	8.978	16 03 46	20.362	0 54 28	2.079	+161	123	21 55
9	.6635	8.976	16 04 58	20.374	0 50 42	1.939	+108	115	20 31
10	.6580	8.964	16 05 50	20.385	0 46 57	1.798	+ 44	106	19 03
11	-0.6525	8.936	16 06 29	20.395	0 43 12	+1.657	- 21	95	17 27
12	.6461	8.892	16 07 07	20.405	0 39 27	1.516	- 76	87	15 40
13	.6381	8.834	16 07 50	20.413	0 35 42	1.373	-116	84	13 42
14	.6277	8.764	16 08 50	20.421	0 31 58	1.231	-134	87	11 47
15	.6151	8.687	16 10 15	20.428	0 28 15	1.089	-128	95	10 04
16	-0.6002	8.612	16 12 07	20.435	0 24 30	+0.946	-100	103	8 37
17	.5837	8.546	16 14 26	20.441	0 20 47	0.803	- 56	106	7 21
18	.5662	8.493	16 17 09	20.446	0 17 03	0.659	- 3	102	6 04
19	.5489	8.461	16 20 07	20.451	0 13 20	0.516	+ 48	90	4 40
20	.5330	8.450	16 23 03	20.455	0 09 36	0.372	+ 84	75	2 52
21	-0.5194	8.458	16 25 47	20.458	0 05 53	+0.228	+ 99	65	0 21
22	.5084	8.476	16 28 05	20.461	0 02 09	+0.083	+ 87	70	21 33
23	.5001	8.495	16 29 55	20.463	23 58 25	-0.061	+ 48	88	19 23
24	.4938	8.504	16 31 13	20.464	23 54 41	0.206	- 12	105	17 44
25	.4882	8.495	16 32 09	20.463	23 50 57	0.350	- 77	115	16 17
26	-0.4816	8.461	16 33 02	20.462	23 47 12	-0.495	-133	117	14 49
27	.4724	8.400	16 34 10	20.459	23 43 27	0.640	-163	110	13 07
28	.4595	8.325	16 35 50	20.455	23 39 42	0.785	-155	104	11 09
29	.4426	8.245	16 38 14	20.451	23 35 56	0.930	-108	102	8 54
30	.4230	8.180	16 41 24	20.445	23 32 09	1.075	- 33	107	6 46
31	-0.4023	8.140	16 44 59	20.437	23 28 23	-1.219	+ 52	115	4 52
32	-0.3827	8.129	16 48 41	20.428	23 24 37	-1.362	+128	121	3 07

BESSELIAN DAY NUMBERS, 1967

FOR 0^h SIDEREAL TIME

Date	A	B	C	D	Date	A	B	C	D
Jan. 0	- 4.397	-6.212	- 3.123	+20.172	Feb. 15	- 1.503	-7.203	-15.613	+11.370
1	4.346	6.266	3.451	20.110	16	1.465	7.186	15.793	11.068
2	4.309	6.298	3.777	20.042	17	1.412	7.166	15.968	10.763
3	4.273	6.307	4.103	19.968	18	1.343	7.151	16.138	10.455
4	4.229	6.293	4.428	19.887	19	1.260	7.148	16.302	10.144
5	- 4.169	-6.262	- 4.752	+19.799	20	- 1.167	-7.163	-16.461	+ 9.831
6	4.088	6.228	5.075	19.705	21	1.072	7.201	16.615	9.515
7	3.989	6.201	5.396	19.605	22	0.987	7.262	16.764	9.197
8	3.876	6.191	5.716	19.498	23	0.920	7.336	16.908	8.876
9	3.760	6.202	6.034	19.384	24	0.877	7.411	17.048	8.553
10	- 3.648	-6.235	- 6.350	+19.264	25	- 0.856	-7.472	-17.182	+ 8.228
11	3.549	6.284	6.664	19.137	26	0.849	7.508	17.312	7.901
12	3.465	6.343	6.976	19.004	27	0.842	7.514	17.436	7.572
13	3.401	6.404	7.285	18.865	28	0.822	7.494	17.556	7.240
14	3.352	6.460	7.592	18.720	Mar. 1	0.782	7.461	17.671	6.906
15	- 3.314	-6.504	- 7.895	+18.569	2	- 0.722	-7.427	-17.780	+ 6.569
16	3.284	6.534	8.196	18.411	3	0.645	7.405	17.885	6.231
17	3.254	6.547	8.494	18.249	4	0.559	7.401	17.984	5.890
18	3.219	6.545	8.788	18.080	5	0.474	7.419	18.077	5.548
19	3.172	6.532	9.080	17.906	6	0.397	7.454	18.164	5.203
20	- 3.112	-6.511	- 9.369	+17.727	7	- 0.333	-7.501	-18.246	+ 4.857
21	3.033	6.492	9.654	17.543	8	0.286	7.556	18.322	4.508
22	2.938	6.482	9.936	17.353	9	0.256	7.610	18.392	4.159
23	2.830	6.488	10.215	17.159	10	0.240	7.656	18.456	3.808
24	2.717	6.516	10.491	16.959	11	0.235	7.687	18.514	3.456
25	- 2.609	-6.568	-10.763	+16.755	12	- 0.235	-7.702	-18.566	+ 3.104
26	2.516	6.639	11.033	16.546	13	0.232	7.700	18.613	2.750
27	2.444	6.719	11.298	16.332	14	0.222	7.682	18.653	2.396
28	2.398	6.793	11.561	16.114	15	0.200	7.654	18.688	2.042
29	2.369	6.847	11.820	15.890	16	0.163	7.620	18.716	1.688
30	- 2.347	-6.874	-12.076	+15.661	17	- 0.110	-7.588	-18.739	+ 1.333
31	2.321	6.876	12.329	15.428	18	- 0.043	7.565	18.756	0.979
Feb. 1	2.279	6.860	12.578	15.189	19	+ 0.035	7.557	18.767	0.625
2	2.218	6.835	12.823	14.946	20	0.119	7.569	18.773	+ 0.271
3	2.139	6.813	13.065	14.698	21	0.199	7.601	18.773	- 0.082
4	- 2.045	-6.805	-13.303	+14.445	22	+ 0.267	-7.653	-18.768	- 0.434
5	1.946	6.817	13.536	14.187	23	0.315	7.713	18.758	0.786
6	1.849	6.849	13.766	13.925	24	0.340	7.766	18.742	1.137
7	1.762	6.899	13.991	13.658	25	0.348	7.800	18.721	1.488
8	1.689	6.962	14.211	13.386	26	0.348	7.804	18.695	1.838
9	- 1.633	-7.028	-14.426	+13.110	27	+ 0.356	-7.778	-18.664	- 2.187
10	1.596	7.091	14.636	12.829	28	0.383	7.731	18.628	2.535
11	1.571	7.144	14.841	12.545	29	0.433	7.676	18.586	2.883
12	1.556	7.182	15.042	12.256	30	0.505	7.628	18.539	3.230
13	1.543	7.204	15.237	11.964	31	0.591	7.598	18.487	3.577
14	- 1.527	-7.210	-15.427	+11.669	Apr. 1	+ 0.679	-7.592	-18.430	- 3.922
15	- 1.503	-7.203	-15.613	+11.370	2	+ 0.761	-7.604	-18.367	- 4.267

E can be taken from pages 258-272 without appreciable error.

FOR 0^h SIDEREAL TIME

Date	A	B	C	D	Date	A	B	C	D
Apr. 1	+ 0.679	-7.592	-18.430	- 3.922	May 17	+ 3.154	-7.248	-10.559	-16.933
2	0.761	7.604	18.367	4.267	18	3.198	7.281	10.297	17.122
3	0.831	7.632	18.299	4.611	19	3.227	7.297	10.032	17.306
4	0.884	7.670	18.225	4.953	20	3.252	7.287	9.765	17.485
5	0.919	7.707	18.145	5.294	21	3.283	7.249	9.496	17.659
6	+ 0.940	-7.737	-18.060	- 5.634	22	+ 3.334	-7.190	- 9.225	-17.828
7	0.949	7.757	17.969	5.972	23	3.410	7.124	8.951	17.992
8	0.954	7.761	17.873	6.308	24	3.510	7.066	8.675	18.152
9	0.958	7.748	17.771	6.642	25	3.626	7.027	8.397	18.307
10	0.968	7.718	17.664	6.973	26	3.746	7.013	8.116	18.458
11	+ 0.989	-7.676	-17.551	- 7.302	27	+ 3.858	-7.024	- 7.834	-18.603
12	1.025	7.626	17.433	7.629	28	3.955	7.052	7.549	18.744
13	1.077	7.576	17.310	7.953	29	4.033	7.088	7.262	18.880
14	1.144	7.533	17.182	8.274	30	4.093	7.123	6.973	19.011
15	1.224	7.505	17.049	8.592	31	4.137	7.150	6.681	19.137
16	+ 1.311	-7.493	-16.911	- 8.907	June 1	+ 4.171	-7.164	- 6.388	-19.257
17	1.397	7.502	16.768	9.219	2	4.201	7.162	6.092	19.372
18	1.475	7.530	16.621	9.528	3	4.232	7.144	5.795	19.482
19	1.537	7.570	16.469	9.834	4	4.272	7.112	5.496	19.586
20	1.579	7.612	16.313	10.136	5	4.324	7.069	5.195	19.685
21	+ 1.602	-7.643	-16.152	-10.435	6	+ 4.391	-7.022	- 4.892	-19.778
22	1.613	7.649	15.987	10.730	7	4.475	6.978	4.588	19.865
23	1.625	7.624	15.818	11.023	8	4.574	6.944	4.283	19.946
24	1.651	7.573	15.645	11.312	9	4.684	6.927	3.977	20.021
25	1.700	7.507	15.468	11.598	10	4.797	6.931	3.669	20.090
26	+ 1.774	-7.440	-15.287	-11.881	11	+ 4.906	-6.956	- 3.361	-20.153
27	1.868	7.387	15.102	12.161	12	5.001	6.996	3.052	20.210
28	1.972	7.359	14.913	12.438	13	5.078	7.045	2.742	20.261
29	2.073	7.354	14.719	12.711	14	5.136	7.092	2.432	20.306
30	2.163	7.368	14.521	12.981	15	5.178	7.125	2.122	20.346
May 1	+ 2.236	-7.394	-14.319	-13.248	16	+ 5.212	-7.136	- 1.811	-20.380
2	2.291	7.423	14.113	13.511	17	5.247	7.122	1.501	20.408
3	2.329	7.449	13.902	13.770	18	5.297	7.084	1.190	20.431
4	2.356	7.465	13.688	14.025	19	5.368	7.035	0.880	20.448
5	2.374	7.467	13.469	14.276	20	5.463	6.986	0.569	20.461
6	+ 2.391	-7.452	-13.247	-14.524	21	+ 5.577	-6.951	- 0.259	-20.467
7	2.412	7.420	13.020	14.766	22	5.702	6.941	+ 0.051	20.469
8	2.443	7.376	12.790	15.005	23	5.825	6.955	0.361	20.465
9	2.488	7.322	12.556	15.239	24	5.936	6.989	0.671	20.456
10	2.549	7.267	12.318	15.468	25	6.029	7.039	0.981	20.443
11	+ 2.626	-7.216	-12.076	-15.692	26	+ 6.102	-7.091	+ 1.291	-20.424
12	2.717	7.178	11.831	15.912	27	6.156	7.138	1.601	20.399
13	2.816	7.158	11.583	16.126	28	6.198	7.173	1.911	20.369
14	2.917	7.158	11.331	16.336	29	6.232	7.193	2.221	20.333
15	3.011	7.176	11.077	16.540	30	6.265	7.196	2.530	20.292
16	+ 3.091	-7.209	-10.819	-16.739	July 1	+ 6.302	-7.185	+ 2.840	-20.245
17	+ 3.154	-7.248	-10.559	-16.933	2	+ 6.351	-7.160	+ 3.148	-20.192

E can be taken from pages 258-272 without appreciable error.

BESSELIAN DAY NUMBERS, 1967

FOR 0^h SIDEREAL TIME

Date	A	B	C	D	Date	A	B	C	D
July 1	-13.739	-7.185	+2.845	-20.243	Aug. 17	-10.502	-7.903	+15.102	-12.170
2	13.690	7.160	3.153	20.191	18	10.419	7.958	15.285	11.893
3	13.627	7.130	3.461	20.132	19	10.353	8.022	15.464	11.613
4	13.548	7.099	3.768	20.068	20	10.307	8.089	15.640	11.331
5	13.454	7.076	4.074	19.998	21	10.277	8.147	15.811	11.045
6	-13.347	-7.068	+4.380	-19.922	22	-10.261	-8.192	+15.978	-10.756
7	13.234	7.079	4.684	19.840	23	10.251	8.220	16.141	10.464
8	13.122	7.113	4.987	19.752	24	10.242	8.230	16.300	10.169
9	13.022	7.165	5.288	19.659	25	10.226	8.224	16.455	9.871
10	12.939	7.230	5.587	19.559	26	10.200	8.206	16.605	9.569
11	-12.876	-7.294	+5.885	-19.454	27	-10.159	-8.183	+16.751	-9.265
12	12.833	7.347	6.180	19.343	28	10.102	8.162	16.893	8.958
13	12.802	7.379	6.474	19.227	29	10.032	8.147	17.030	8.648
14	12.772	7.386	6.765	19.105	30	9.951	8.148	17.163	8.334
15	12.732	7.371	7.054	18.979	31	9.864	8.167	17.290	8.018
16	-12.674	-7.341	+7.341	-18.847	Sept. 1	-9.778	-8.206	+17.413	-7.699
17	12.594	7.306	7.626	18.711	2	9.704	8.263	17.531	7.378
18	12.494	7.281	7.909	18.569	3	9.647	8.333	17.644	7.054
19	12.380	7.274	8.189	18.423	4	9.613	8.399	17.751	6.727
20	12.264	7.291	8.467	18.272	5	9.597	8.452	17.853	6.398
21	-12.155	-7.332	+8.743	-18.117	6	-9.593	-8.478	+17.950	-6.067
22	12.062	7.389	9.016	17.957	7	9.587	8.475	18.041	5.734
23	11.988	7.455	9.287	17.792	8	9.567	8.448	18.126	5.400
24	11.935	7.518	9.556	17.623	9	9.524	8.406	18.206	5.064
25	11.897	7.571	9.823	17.449	10	9.460	8.367	18.280	4.727
26	-11.869	-7.610	+10.087	-17.270	11	-9.377	-8.342	+18.349	-4.389
27	11.846	7.632	10.349	17.087	12	9.288	8.337	18.413	4.049
28	11.820	7.637	10.609	16.898	13	9.200	8.356	18.472	3.709
29	11.786	7.627	10.866	16.705	14	9.122	8.393	18.525	3.367
30	11.739	7.609	11.120	16.507	15	9.061	8.443	18.574	3.025
31	-11.678	-7.588	+11.372	-16.304	16	-9.018	-8.498	+18.617	-2.683
Aug. 1	11.601	7.572	11.621	16.096	17	8.995	8.548	18.655	2.339
2	11.510	7.567	11.867	15.883	18	8.984	8.585	18.688	1.995
3	11.410	7.579	12.109	15.666	19	8.982	8.606	18.716	1.650
4	11.308	7.612	12.348	15.444	20	8.981	8.609	18.739	1.305
5	-11.212	-7.665	+12.584	-15.216	21	-8.976	-8.594	+18.757	-0.959
6	11.132	7.735	12.816	14.985	21	8.961	8.566	18.770	0.613
7	11.073	7.810	13.044	14.749	22	8.933	8.530	18.778	-0.266
8	11.036	7.878	13.269	14.508	23	8.890	8.493	18.780	+0.082
9	11.014	7.926	13.489	14.263	24	8.832	8.460	18.778	0.430
10	-10.997	-7.948	+13.705	-14.014	25	-8.762	-8.439	+18.770	+0.779
11	10.975	7.943	13.917	13.760	26	8.684	8.435	18.756	1.128
12	10.936	7.920	14.125	13.504	27	8.604	8.449	18.737	1.477
13	10.876	7.890	14.329	13.243	28	8.530	8.482	18.713	1.827
14	10.795	7.865	14.528	12.980	29	8.469	8.529	18.682	2.176
15	-10.700	-7.856	+14.724	-12.713	30	-8.428	-8.581	+18.647	+2.525
16	10.599	7.869	14.915	12.443	Oct. 1	8.406	8.627	18.605	2.874
17	-10.502	-7.903	+15.102	-12.170	2	-8.401	-8.653	+18.557	+3.223

E can be taken from pages 258-272 without appreciable error.

FOR 0^h SIDEREAL TIME

Date	A	B	C	D	Date	A	B	C	D
Oct. 1	- 8.406	-8.627	+18.605	+ 2.874	Nov. 16	- 6.088	-8.010	+11.092	+16.505
2	8.401	8.653	18.557	3.223	17	6.016	7.956	10.826	16.714
3	8.399	8.647	18.503	3.571	18	5.930	7.909	10.557	16.918
4	8.389	8.613	18.443	3.918	19	5.833	7.877	10.284	17.117
5	8.357	8.557	18.378	4.264	20	5.732	7.862	10.008	17.311
6	- 8.300	-8.495	+18.307	+ 4.609	21	- 5.630	-7.866	+ 9.728	+17.501
7	8.220	8.444	18.230	4.951	22	5.538	7.887	9.446	17.685
8	8.127	8.413	18.148	5.292	23	5.458	7.920	9.160	17.865
9	8.032	8.408	18.060	5.631	24	5.396	7.955	8.870	18.039
10	7.946	8.424	17.966	5.969	25	5.351	7.983	8.578	18.208
11	- 7.876	-8.456	+17.868	+ 6.304	26	- 5.318	-7.994	+ 8.282	+18.372
12	7.825	8.493	17.765	6.637	27	5.288	7.979	7.984	18.530
13	7.792	8.528	17.656	6.969	28	5.250	7.938	7.682	18.682
14	7.774	8.553	17.543	7.298	29	5.191	7.877	7.378	18.829
15	7.765	8.563	17.424	7.625	30	5.105	7.810	7.071	18.969
16	- 7.760	-8.556	+17.301	+ 7.950	Dec. 1	- 4.993	-7.751	+ 6.761	+19.103
17	7.751	8.531	17.173	8.273	2	4.864	7.715	6.450	19.230
18	7.735	8.491	17.039	8.594	3	4.734	7.708	6.136	19.351
19	7.705	8.441	16.901	8.912	4	4.613	7.727	5.820	19.466
20	7.660	8.388	16.758	9.228	5	4.511	7.762	5.502	19.574
21	- 7.600	-8.338	+16.610	+ 9.542	6	- 4.432	-7.804	+ 5.183	+19.675
22	7.527	8.298	16.457	9.854	7	4.372	7.841	4.862	19.771
23	7.445	8.272	16.300	10.163	8	4.327	7.866	4.540	19.859
24	7.358	8.265	16.137	10.470	9	4.291	7.875	4.216	19.942
25	7.274	8.275	15.970	10.774	10	4.255	7.866	3.892	20.018
26	- 7.199	-8.303	+15.797	+11.075	11	- 4.215	-7.842	+ 3.567	+20.088
27	7.141	8.338	15.619	11.374	12	4.166	7.806	3.241	20.152
28	7.101	8.374	15.436	11.669	13	4.103	7.763	2.914	20.210
29	7.078	8.395	15.248	11.962	14	4.023	7.719	2.586	20.262
30	7.064	8.394	15.054	12.251	15	3.930	7.682	2.258	20.308
31	- 7.048	-8.362	+14.856	+12.536	16	- 3.825	-7.658	+ 1.929	+20.348
Nov. 1	7.016	8.305	14.652	12.818	17	3.712	7.651	1.599	20.382
2	6.958	8.232	14.444	13.095	18	3.599	7.664	1.269	20.410
3	6.874	8.162	14.231	13.369	19	3.493	7.695	0.938	20.432
4	6.770	8.107	14.013	13.638	20	3.400	7.741	0.607	20.448
5	- 6.655	-8.080	+13.791	+13.903	21	- 3.325	-7.791	+ 0.275	+20.458
6	6.546	8.079	13.565	14.163	22	3.266	7.837	- 0.057	20.462
7	6.453	8.098	13.334	14.418	23	3.223	7.869	0.389	20.459
8	6.378	8.129	13.100	14.668	24	3.186	7.879	0.722	20.450
9	6.323	8.158	12.861	14.914	25	3.146	7.866	1.055	20.435
10	- 6.285	-8.182	+12.619	+15.155	26	- 3.091	-7.830	- 1.388	+20.413
11	6.258	8.190	12.373	15.392	27	3.014	7.783	1.722	20.384
12	6.237	8.182	12.124	15.624	28	2.911	7.737	2.055	20.349
13	6.215	8.158	11.871	15.851	29	2.787	7.708	2.387	20.307
14	6.185	8.118	11.615	16.074	30	2.654	7.704	2.719	20.258
15	- 6.144	-8.066	+11.355	+16.292	31	- 2.523	-7.728	- 3.050	+20.202
16	- 6.088	-8.010	+11.092	+16.505	32	- 2.408	-7.776	- 3.380	+20.138

E can be taken from pages 258-272 without appreciable error.

FOR NORTHERN DECLINATIONS
FOR 0^h EPHEMERIS TIME

R.A.		0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	8 ^h	9 ^h	10 ^h	11 ^h	12 ^h
Date		12 ^h	13 ^h	14 ^h	15 ^h	16 ^h	17 ^h	18 ^h	19 ^h	20 ^h	21 ^h	22 ^h	23 ^h	24 ^h
J (0 ^s .00001)														
Jan.	0	- 5	- 3	0	+ 3	+ 5	+ 5	+ 5	+ 3	0	- 3	- 5	- 5	- 5
	10	- 6	- 5	- 2	+ 1	+ 4	+ 6	+ 6	+ 5	+ 2	- 1	- 4	- 6	- 6
	20	- 8	- 7	- 4	0	+ 3	+ 6	+ 8	+ 7	+ 4	0	- 3	- 6	- 8
	30	- 8	- 9	- 6	- 3	+ 2	+ 6	+ 8	+ 9	+ 6	+ 3	- 2	- 6	- 8
Feb.	9	- 8	-10	- 8	- 5	0	+ 4	+ 8	+10	+ 8	+ 5	0	- 4	- 8
	19	- 7	-10	-10	- 8	- 3	+ 2	+ 7	+10	+10	+ 8	+ 3	- 2	- 7
Mar.	1	- 5	- 9	-11	-10	- 6	0	+ 5	+ 9	+11	+10	+ 6	0	- 5
	11	- 3	- 8	-11	-11	- 8	- 3	+ 3	+ 8	+11	+11	+ 8	+ 3	- 3
	21	0	- 6	-10	-11	-10	- 5	0	+ 6	+10	+11	+10	+ 5	0
	31	+ 2	- 3	- 8	-11	-11	- 8	- 2	+ 3	+ 8	+11	+11	+ 8	+ 2
Apr.	10	+ 5	- 1	- 6	-10	-11	- 9	- 5	+ 1	+ 6	+10	+11	+ 9	+ 5
	20	+ 7	+ 2	- 4	- 8	-10	-10	- 7	- 2	+ 4	+ 8	+10	+10	+ 7
	30	+ 8	+ 4	- 1	- 6	- 9	-10	- 8	- 4	+ 1	+ 6	+ 9	+10	+ 8
May	10	+ 8	+ 5	+ 1	- 4	- 7	- 9	- 8	- 5	- 1	+ 4	+ 7	+ 9	+ 8
	20	+ 8	+ 6	+ 3	- 2	- 5	- 8	- 8	- 6	- 3	+ 2	+ 5	+ 8	+ 8
	30	+ 7	+ 6	+ 4	0	- 3	- 6	- 7	- 6	- 4	0	+ 3	+ 6	+ 7
June	9	+ 5	+ 6	+ 4	+ 2	- 1	- 4	- 5	- 6	- 4	- 2	+ 1	+ 4	+ 5
	19	+ 4	+ 5	+ 4	+ 3	0	- 2	- 4	- 5	- 4	- 3	0	+ 2	+ 4
	29	+ 2	+ 3	+ 4	+ 3	+ 1	- 1	- 2	- 3	- 4	- 3	- 1	+ 1	+ 2
July	9	+ 1	+ 2	+ 3	+ 3	+ 2	+ 1	- 1	- 2	- 3	- 3	- 2	- 1	+ 1
June	29	+ 6	+14	+19	+18	+13	+ 4	- 6	-14	-19	-18	-13	- 4	+ 6
July	9	+ 2	+10	+16	+17	+14	+ 7	- 2	-10	-16	-17	-14	- 7	+ 2
	19	- 1	+ 7	+13	+15	+14	+ 8	+ 1	- 7	-13	-15	-14	- 8	- 1
	29	- 3	+ 4	+10	+13	+13	+ 9	+ 3	- 4	-10	-13	-13	- 9	- 3
Aug.	8	- 4	+ 1	+ 7	+10	+11	+ 9	+ 4	- 1	- 7	-10	-11	- 9	- 4
	18	- 5	- 1	+ 4	+ 7	+ 9	+ 8	+ 5	+ 1	- 4	- 7	- 9	- 8	- 5
	28	- 5	- 2	+ 1	+ 5	+ 7	+ 7	+ 5	+ 2	- 1	- 5	- 7	- 7	- 5
Sept.	7	- 5	- 3	0	+ 2	+ 4	+ 5	+ 5	+ 3	0	- 2	- 4	- 5	- 5
	17	- 4	- 3	- 1	0	+ 2	+ 3	+ 4	+ 3	+ 1	0	- 2	- 3	- 4
	27	- 2	- 3	- 2	- 1	+ 1	+ 2	+ 2	+ 3	+ 2	+ 1	- 1	- 2	- 2
Oct.	7	- 1	- 2	- 2	- 1	- 1	0	+ 1	+ 2	+ 2	+ 1	+ 1	0	- 1
	17	0	- 1	- 1	- 1	- 1	- 1	0	+ 1	+ 1	+ 1	+ 1	+ 1	0
	27	+ 1	0	0	- 1	- 1	- 1	- 1	0	0	+ 1	+ 1	+ 1	+ 1
Nov.	6	+ 1	+ 1	+ 1	0	0	- 1	- 1	- 1	- 1	0	0	+ 1	+ 1
	16	+ 1	+ 2	+ 2	+ 2	+ 1	0	- 1	- 2	- 2	- 2	- 1	0	+ 1
	26	0	+ 2	+ 2	+ 3	+ 2	+ 1	0	- 2	- 2	- 3	- 2	- 1	0
Dec.	6	- 1	+ 1	+ 3	+ 4	+ 4	+ 3	+ 1	- 1	- 3	- 4	- 4	- 3	- 1
	16	- 3	- 1	+ 2	+ 4	+ 5	+ 4	+ 3	+ 1	- 2	- 4	- 5	- 4	- 3
	26	- 5	- 3	+ 1	+ 4	+ 6	+ 6	+ 5	+ 3	- 1	- 4	- 6	- 6	- 5
	36	- 7	- 5	- 1	+ 3	+ 6	+ 7	+ 7	+ 5	+ 1	- 3	- 6	- 7	- 7

The quantity J is given in this table in units of 0^s.00001, and is to be multiplied by $\tan^2\delta_0$ to give the second-order correction in the calculation of the apparent right ascension of a star.

The complete formula is :

$$\alpha = \alpha_0 + \tau\mu_\alpha + Aa + Bb + Cc + Dd + E + J \tan^2\delta_0$$

FOR NORTHERN DECLINATIONS
FOR 0^h EPHEMERIS TIME

R.A.		0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	8 ^h	9 ^h	10 ^h	11 ^h	12 ^h
Date		12 ^h	13 ^h	14 ^h	15 ^h	16 ^h	17 ^h	18 ^h	19 ^h	20 ^h	21 ^h	22 ^h	23 ^h	24 ^h
J' (0".0001)														
Jan.	0	- 2	- 1	0	- 1	- 2	- 4	- 6	- 7	- 8	- 7	- 6	- 4	- 2
	10	- 4	- 1	0	0	- 1	- 3	- 6	- 8	- 9	- 9	- 8	- 6	- 4
	20	- 6	- 3	- 1	0	- 1	- 2	- 5	- 8	-10	-11	-11	- 9	- 6
	30	- 9	- 5	- 2	0	0	- 2	- 4	- 8	-11	-13	-13	-11	- 9
Feb.	9	-11	- 8	- 4	- 1	0	- 1	- 3	- 7	-10	-13	-14	-14	-11
	19	-13	-10	- 6	- 3	0	0	- 2	- 5	- 9	-13	-15	-15	-13
Mar.	1	-13	-12	- 8	- 4	- 1	0	- 1	- 4	- 8	-12	-15	-16	-13
	11	-15	-14	-11	- 6	- 3	0	0	- 2	- 6	-11	-14	-17	-15
	21	-17	-16	-12	- 8	- 4	- 1	0	- 1	- 4	- 9	-13	-16	-17
	31	-17	-16	-14	-10	- 6	- 2	0	0	- 3	- 7	-11	-15	-17
Apr.	10	-16	-17	-15	-12	- 8	- 4	- 1	0	- 1	- 5	- 9	-13	-16
	20	-14	-16	-15	-13	- 9	- 5	- 2	0	- 1	- 3	- 7	-11	-14
	30	-12	-14	-14	-13	-10	- 6	- 3	- 1	0	- 2	- 5	- 8	-12
May	10	- 9	-12	-13	-13	-11	- 8	- 4	- 1	0	- 1	- 3	- 6	- 9
	20	- 7	-10	-12	-12	-11	- 8	- 5	- 2	0	0	- 1	- 4	- 7
	30	- 5	- 8	- 9	-10	-10	- 8	- 5	- 3	- 1	0	- 1	- 2	- 5
June	9	- 3	- 5	- 7	- 8	- 9	- 8	- 6	- 3	- 1	0	0	- 1	- 3
	19	- 2	- 3	- 5	- 6	- 7	- 7	- 6	- 4	- 2	- 1	0	0	- 2
	29	- 1	- 2	- 3	- 4	- 5	- 5	- 5	- 4	- 2	- 1	0	0	- 1
July	9	0	- 1	- 2	- 3	- 3	- 4	- 4	- 3	- 2	- 1	- 1	0	0
June	29	- 1	- 5	-11	-19	-25	-29	-28	-24	-18	-10	- 4	0	- 1
July	9	0	- 3	- 8	-15	-21	-25	-26	-23	-18	-12	- 5	- 1	0
	19	0	- 1	- 5	-11	-17	-21	-23	-22	-18	-12	- 6	- 2	0
	29	0	0	- 3	- 8	-13	-17	-20	-20	-17	-12	- 7	- 3	0
Aug.	8	- 1	0	- 2	- 5	- 9	-13	-16	-17	-15	-12	- 7	- 3	- 1
	18	- 1	0	- 1	- 3	- 6	- 9	-12	-13	-13	-11	- 7	- 4	- 1
	28	- 2	0	0	- 1	- 4	- 6	- 9	-10	-11	- 9	- 7	- 4	- 2
Sept.	7	- 2	- 1	0	0	- 2	- 4	- 6	- 7	- 8	- 8	- 6	- 4	- 2
	17	- 2	- 1	0	0	- 1	- 2	- 3	- 4	- 5	- 6	- 5	- 4	- 2
	27	- 3	- 2	- 1	0	0	- 1	- 1	- 2	- 3	- 4	- 4	- 3	- 3
Oct.	7	- 2	- 2	- 1	0	0	0	0	- 1	- 2	- 2	- 3	- 3	- 2
	17	- 2	- 2	- 1	- 1	0	0	0	0	0	- 1	- 1	- 2	- 2
	27	- 1	- 2	- 2	- 2	- 1	- 1	0	0	0	0	0	- 1	- 1
Nov.	6	- 1	- 1	- 2	- 2	- 2	- 2	- 1	- 1	0	0	0	0	- 1
	16	0	- 1	- 2	- 2	- 3	- 3	- 3	- 2	- 1	- 1	0	0	0
	26	0	0	- 1	- 2	- 3	- 4	- 4	- 4	- 3	- 2	- 1	0	0
Dec.	6	0	0	- 1	- 2	- 3	- 5	- 6	- 6	- 5	- 4	- 2	- 1	0
	16	- 1	0	0	- 1	- 3	- 5	- 7	- 7	- 7	- 6	- 4	- 2	- 1
	26	- 2	0	0	- 1	- 3	- 5	- 7	- 9	- 9	- 8	- 7	- 4	- 2
	36	- 4	- 1	0	0	- 2	- 5	- 8	-10	-11	-11	- 9	- 7	- 4

The quantity J' is given in this table in units of 0".0001, and is to be multiplied by $\tan \delta_0$ to give the second-order correction in the calculation of the apparent declination of a star.

The complete formula is :

$$\delta = \delta_0 + \tau\mu_\delta + Aa' + Bb' + Cc' + Dd' + J' \tan \delta_0$$

SECOND-ORDER DAY NUMBER J , 1967

FOR SOUTHERN DECLINATIONS
FOR 0^h EPHEMERIS TIME

R.A.		0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	8 ^h	9 ^h	10 ^h	11 ^h	12 ^h
Date		12 ^h	13 ^h	14 ^h	15 ^h	16 ^h	17 ^h	18 ^h	19 ^h	20 ^h	21 ^h	22 ^h	23 ^h	24 ^h
J (0 ^s .00001)														
Jan.	0	+ 3	+ 7	+10	+10	+ 7	+ 3	- 3	- 7	-10	-10	- 7	- 3	+ 3
	10	0	+ 4	+ 7	+ 9	+ 7	+ 4	0	- 4	- 7	- 9	- 7	- 4	0
	20	- 2	+ 2	+ 5	+ 7	+ 7	+ 5	+ 2	- 2	- 5	- 7	- 7	- 5	- 2
	30	- 3	0	+ 3	+ 5	+ 6	+ 5	+ 3	0	- 3	- 5	- 6	- 5	- 3
Feb.	9	- 4	- 2	+ 1	+ 3	+ 4	+ 4	+ 4	+ 2	- 1	- 3	- 4	- 4	- 4
	19	- 3	- 3	- 1	+ 1	+ 2	+ 3	+ 3	+ 3	+ 1	- 1	- 2	- 3	- 3
Mar.	1	- 3	- 3	- 2	- 1	+ 1	+ 2	+ 3	+ 3	+ 2	+ 1	- 1	- 2	- 3
	11	- 1	- 2	- 2	- 2	- 1	0	+ 1	+ 2	+ 2	+ 2	+ 1	0	- 1
	21	0	- 1	- 2	- 2	- 2	- 1	0	+ 1	+ 2	+ 2	+ 2	+ 1	0
	31	+ 1	0	- 1	- 2	- 2	- 2	- 1	0	+ 1	+ 2	+ 2	+ 2	+ 1
Apr.	10	+ 3	+ 2	+ 1	- 1	- 2	- 2	- 3	- 2	- 1	+ 1	+ 2	+ 2	+ 3
	20	+ 3	+ 3	+ 2	+ 1	- 1	- 2	- 3	- 3	- 2	- 1	+ 1	+ 2	+ 3
	30	+ 3	+ 4	+ 4	+ 3	+ 1	- 2	- 3	- 4	- 4	- 3	- 1	+ 2	+ 3
May	10	+ 3	+ 5	+ 6	+ 5	+ 3	0	- 3	- 5	- 6	- 5	- 3	0	+ 3
	20	+ 2	+ 5	+ 7	+ 7	+ 5	+ 2	- 2	- 5	- 7	- 7	- 5	- 2	+ 2
	30	0	+ 4	+ 7	+ 9	+ 8	+ 4	0	- 4	- 7	- 9	- 8	- 4	0
June	9	- 2	+ 3	+ 7	+10	+10	+ 7	+ 2	- 3	- 7	-10	-10	- 7	- 2
	19	- 5	+ 1	+ 6	+10	+11	+ 9	+ 5	- 1	- 6	-10	-11	- 9	- 5
	29	- 8	- 2	+ 5	+10	+13	+12	+ 8	+ 2	- 5	-10	-13	-12	- 8
July	9	-11	- 5	+ 2	+ 9	+13	+14	+11	+ 5	- 2	- 9	-13	-14	-11
June	29	- 2	- 2	- 2	- 1	0	+ 1	+ 2	+ 2	+ 2	+ 1	0	- 1	- 2
July	9	- 3	- 3	- 3	- 2	0	+ 1	+ 3	+ 3	+ 3	+ 2	0	- 1	- 3
	19	- 3	- 4	- 4	- 3	- 1	+ 1	+ 3	+ 4	+ 4	+ 3	+ 1	- 1	- 3
	29	- 2	- 5	- 6	- 5	- 3	0	+ 2	+ 5	+ 6	+ 5	+ 3	0	- 2
Aug.	8	- 2	- 6	- 7	- 7	- 5	- 1	+ 2	+ 6	+ 7	+ 7	+ 5	+ 1	- 2
	18	- 1	- 5	- 8	- 9	- 7	- 3	+ 1	+ 5	+ 8	+ 9	+ 7	+ 3	- 1
	28	+ 1	- 4	- 8	-10	- 9	- 6	- 1	+ 4	+ 8	+10	+ 9	+ 6	+ 1
Sept.	7	+ 3	- 3	- 8	-11	-11	- 8	- 3	+ 3	+ 8	+11	+11	+ 8	+ 3
	17	+ 6	- 1	- 7	-11	-13	-11	- 6	+ 1	+ 7	+11	+13	+11	+ 6
	27	+ 9	+ 2	- 5	-10	-13	-13	- 9	- 2	+ 5	+10	+13	+13	+ 9
Oct.	7	+11	+ 5	- 2	- 9	-13	-14	-11	- 5	+ 2	+ 9	+13	+14	+11
	17	+13	+ 8	+ 1	- 7	-13	-15	-13	- 8	- 1	+ 7	+13	+15	+13
	27	+14	+10	+ 4	- 4	-11	-14	-14	-10	- 4	+ 4	+11	+14	+14
Nov.	6	+15	+12	+ 7	- 1	- 8	-13	-15	-12	- 7	+ 1	+ 8	+13	+15
	16	+14	+13	+ 9	+ 2	- 5	-11	-14	-13	- 9	- 2	+ 5	+11	+14
	26	+13	+13	+10	+ 5	- 2	- 9	-13	-13	-10	- 5	+ 2	+ 9	+13
Dec.	6	+10	+12	+11	+ 7	+ 1	- 6	-10	-12	-11	- 7	- 1	+ 6	+10
	16	+ 8	+11	+11	+ 8	+ 3	- 3	- 8	-11	-11	- 8	- 3	+ 3	+ 8
	26	+ 5	+ 9	+10	+ 8	+ 5	0	- 5	- 9	-10	- 8	- 5	0	+ 5
	36	+ 3	+ 6	+ 8	+ 8	+ 5	+ 2	- 3	- 6	- 8	- 8	- 5	- 2	+ 3

The quantity J is given in this table in units of 0^s.00001, and is to be multiplied by $\tan^2\delta_0$ to give the second-order correction in the calculation of the apparent right ascension of a star.

The complete formula is :

$$\alpha = \alpha_0 + \tau\mu_\alpha + Aa + Bb + Cc + Dd + E + J \tan^2\delta_0$$

FOR SOUTHERN DECLINATIONS
FOR 0^h EPHEMERIS TIME

R.A.		0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	8 ^h	9 ^h	10 ^h	11 ^h	12 ^h
Date		12 ^h	13 ^h	14 ^h	15 ^h	16 ^h	17 ^h	18 ^h	19 ^h	20 ^h	21 ^h	22 ^h	23 ^h	24 ^h
J' (0".0001)														
Jan.	0	0	-2	-6	-10	-13	-15	-15	-13	-9	-6	-2	0	0
	10	0	-1	-3	-7	-10	-12	-13	-12	-10	-6	-3	-1	0
	20	0	0	-2	-4	-7	-9	-11	-11	-9	-7	-4	-2	0
	30	-1	0	-1	-2	-4	-6	-8	-9	-8	-7	-4	-2	-1
Feb.	9	-1	0	0	-1	-2	-4	-5	-7	-7	-6	-5	-3	-1
	19	-2	-1	0	0	-1	-2	-3	-4	-5	-5	-5	-3	-2
Mar.	1	-2	-1	-1	0	0	-1	-2	-3	-3	-4	-4	-3	-2
	11	-3	-2	-1	-1	0	0	0	-1	-2	-3	-3	-3	-3
	21	-3	-3	-2	-2	-1	0	0	0	-1	-1	-2	-3	-3
	31	-3	-3	-3	-3	-2	-1	0	0	0	-1	-1	-2	-3
Apr.	10	-2	-3	-4	-4	-3	-2	-1	-1	0	0	-1	-1	-2
	20	-2	-3	-4	-5	-5	-4	-3	-2	-1	0	0	-1	-2
	30	-1	-3	-5	-6	-7	-7	-5	-4	-2	-1	0	0	-1
May	10	-1	-2	-4	-6	-8	-8	-8	-6	-4	-2	0	0	-1
	20	0	-2	-4	-7	-9	-10	-10	-9	-7	-4	-2	0	0
	30	0	-1	-3	-6	-10	-12	-13	-12	-10	-7	-3	-1	0
June	9	0	0	-2	-6	-10	-13	-15	-15	-13	-9	-5	-2	0
	19	-1	0	-1	-5	-9	-13	-16	-17	-16	-12	-8	-4	-1
	29	-2	0	-1	-4	-8	-13	-17	-19	-19	-16	-11	-6	-2
July	9	-4	-1	0	-2	-7	-12	-17	-20	-21	-18	-14	-9	-4
June	29	-2	-1	-1	0	0	0	-1	-2	-3	-3	-3	-3	-2
July	9	-4	-3	-1	0	0	0	-1	-2	-3	-4	-5	-5	-4
	19	-6	-4	-3	-1	0	0	-1	-2	-4	-6	-6	-7	-6
	29	-8	-7	-4	-2	-1	0	-1	-2	-4	-7	-8	-9	-8
Aug.	8	-11	-9	-7	-4	-1	0	0	-2	-4	-7	-10	-11	-11
	18	-13	-12	-9	-6	-3	-1	0	-1	-4	-7	-10	-13	-13
	28	-15	-14	-12	-8	-4	-1	0	-1	-3	-7	-11	-14	-15
Sept.	7	-17	-17	-15	-11	-7	-3	0	0	-2	-6	-11	-15	-17
	17	-18	-19	-18	-14	-9	-4	-1	0	-1	-5	-10	-15	-18
	27	-18	-20	-20	-17	-12	-7	-2	0	-1	-4	-8	-14	-18
Oct.	7	-17	-21	-21	-19	-15	-9	-4	-1	0	-2	-7	-12	-17
	17	-16	-21	-22	-21	-17	-12	-6	-2	0	-1	-5	-11	-16
	27	-14	-19	-22	-22	-19	-14	-8	-3	0	0	-3	-8	-14
Nov.	6	-12	-17	-21	-22	-20	-16	-10	-5	-1	0	-2	-6	-12
	16	-9	-15	-19	-21	-21	-17	-12	-7	-2	0	-1	-4	-9
	26	-7	-12	-17	-20	-20	-18	-13	-8	-4	-1	0	-2	-7
Dec.	6	-4	-9	-13	-17	-18	-17	-14	-10	-5	-1	0	-1	-4
	16	-2	-6	-10	-14	-16	-16	-14	-10	-6	-2	0	0	-2
	26	-1	-4	-8	-11	-14	-15	-14	-11	-7	-3	-1	0	-1
	36	0	-2	-5	-8	-11	-12	-12	-10	-7	-4	-2	0	0

The quantity J' is given in this table in units of 0".0001, and is to be multiplied by $\tan \delta_0$ to give the second-order correction in the calculation of the apparent declination of a star.

The complete formula is :

$$\delta = \delta_0 + \tau\mu_\delta + Aa' + Bb' + Cc' + Dd' + J' \tan \delta_0$$

FOR JANUARY 1^d.041

Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
30 Psc	4.7	M3	0 00 16.0	- 6 11 51	δ Phe	4.0	K0	1 29 52.7	-49 14 38
2 Cet	4.6	A0	0 02 03.0	-17 31 11	ν And	4.2	G0	1 34 51.1	+41 14 28
33 Psc	4.7	K0	0 03 38.7	- 5 53 32	51 And	3.8	K0	1 35 57.3	+48 27 42
α And	2.1	A0p	0 06 40.6	+28 54 30	α Eri	0.6	B5	1 36 29.2	-57 24 15
β Cas	2.4	F5	0 07 24.3	+58 58 04	ν Psc	4.7	K0	1 39 42.7	+ 5 19 16
ε Phe	3.9	K0	0 07 44.4	-45 55 46	φ Per	4.2	B0p	1 41 34.8	+50 31 24
γ Peg	2.9	B2	0 11 32.0	+15 00 01	τ Cet	3.6	K0	1 42 32.0	-16 06 38
7 Cet	4.7	M1	0 12 57.9	-19 06 56	ο Psc	4.5	K0	1 43 38.9	+ 8 59 32
θ And	4.4	A2	0 15 21.6	+38 29 54	ζ Cet	3.9	K0	1 49 49.8	-10 29 51
σ And	4.5	A2	0 16 35.8	+36 36 09	α Tri	3.6	F5	1 51 11.6	+29 25 08
ι Cet	3.7	K0	0 17 44.7	- 9 00 24	γ Ari	4.7	A0p	1 51 42.9	+19 07 57
ζ Tuc	4.3	F8	0 18 21.8	-65 04 07	ε Cas	3.4	B3	1 52 00.0	+63 30 31
β Hyi	2.9	G0	0 24 02.6	-77 26 24	ψ Phe	4.4	M3	1 52 19.4	-46 27 50
κ Phe	3.9	A3	0 24 35.0	-43 51 47	β Ari	2.7	A5	1 52 48.7	+20 38 51
α Phe	2.4	K0	0 24 39.4	-42 29 07	η ² Hyi	4.7	K0	1 54 05.7	-67 48 33
β Tuc	4.5	A2	0 30 03.2	-63 08 51	χ Eri	3.7	G5	1 54 40.5	-51 46 22
κ Cas	4.2	B0	0 31 06.5	+62 45 00	-47°597	4.7	G5	1 55 51.5	-47 32 45
π And	4.5	B3	0 35 06.7	+33 32 16	α Hyi	3.0	F0	1 57 43.8	-61 43 48
ζ Cas	3.7	B3	0 35 07.3	+53 42 56	ν Cet	4.2	M0	1 58 26.9	-21 14 13
ε And	4.5	G5	0 36 48.4	+29 07 58	48 Cas	4.6	A3	1 59 12.6	+70 44 54
δ And	3.5	K2	0 37 33.4	+30 40 50	α Psc	4.3	A2p	2 00 20.2	+ 2 36 18
α Cas	2.3	K0	0 38 37.3	+56 21 24	50 Cas	4.1	A2	2 00 34.7	+72 15 46
μ Phe	4.6	K0	0 39 46.1	-46 15 58	γ ¹ And	2.3	K0	2 01 51.9	+42 10 20
η Phe	4.5	A0	0 41 52.5	-57 38 38	ν For	4.7	A0p	2 03 00.7	-29 27 17
β Cet	2.2	K0	0 41 56.0	-18 10 03	α U Mi	2.1	F8	2 00 56.6	+89 06 43
ο Cas	4.7	B2	0 42 52.6	+48 06 15	α Ari	2.2	K2	2 05 18.5	+23 18 26
ζ And	4.3	K0	0 45 35.1	+24 05 17	β Tri	3.1	A5	2 07 34.4	+34 49 55
δ Psc	4.5	K5	0 46 58.0	+ 7 24 21	ξ ¹ Cet	4.5	G5	2 11 14.8	+ 8 41 34
η Cas	3.6	F8	0 47 05.2	+57 38 28	φ Eri	3.8	B8	2 15 19.8	-51 39 52
ν And	4.4	B3	0 47 59.1	+40 53 58	γ Tri	4.1	A0	2 15 20.7	+33 41 44
γ Cas	Var.	B0p	0 54 42.1	+60 32 19	ο Cet	2-10	M5e	2 17 40.6	- 3 07 36
μ And	3.9	A2	0 54 54.8	+38 19 15	δ Hyi	4.3	A2	2 21 09.4	-68 48 33
η And	4.6	G5	0 55 26.4	+23 14 24	κ Eri	4.4	B5	2 25 46.5	-47 51 05
α Scl	4.4	B5	0 57 01.0	-29 32 08	ξ ² Cet	4.3	A0	2 26 24.1	+ 8 18 47
ε Psc	4.4	K0	1 01 13.7	+ 7 42 46	ι Cas	4.6	A5p	2 26 19.2	+67 15 20
43 H. Cep	4.5	K0	1 03 52.9	+86 04 52	δ Cet	4.0	B2	2 37 47.3	+ 0 11 14
β Phe	3.3	K0	1 04 36.8	-46 53 42	s Eri	4.5	A2	2 38 32.5	-43 01 58
η Cet	3.6	K0	1 06 55.7	-10 21 24	ε Hyi	4.3	B9	2 39 04.5	-68 24 29
ζ Phe	4.1	B8	1 07 00.0	-55 25 19	ι Eri	4.1	K0	2 39 21.9	-39 59 45
φ And	4.3	B8	1 07 34.6	+47 03 59	35 Ari	4.6	B3	2 41 30.6	+27 34 04
β And	2.4	M0	1 07 52.6	+35 26 46	γ Cet	3.6	A2	2 41 35.3	+ 3 05 51
θ Cas	4.5	A5	1 09 04.8	+54 58 29	θ Per	4.2	F8	2 41 56.1	+49 05 24
τ Psc	4.7	K0	1 09 50.2	+29 54 54	π Cet	4.4	B5	2 42 33.0	-13 59 51
φ Psc	4.6	K0	1 11 57.1	+24 24 33	μ Cet	4.4	F0	2 43 09.3	+ 9 58 33
ν Psc	4.7	A2	1 17 38.8	+27 05 28	1 Eri	4.6	F5	2 43 33.7	-18 42 41
θ Cet	3.8	K0	1 22 22.3	- 8 21 12	39 Ari	4.6	K0	2 45 56.3	+29 06 40
δ Cas	2.8	A5	1 23 38.4	+60 03 52	β For	4.5	K0	2 47 42.5	-32 32 37
γ Phe	3.4	K5	1 26 56.0	-43 29 13	41 Ari	3.7	B8	2 48 02.1	+27 07 32
η Psc	3.7	G5	1 29 42.8	+15 10 34	η Per	3.9	K0	2 48 16.5	+55 45 36

FOR JANUARY 1^d.041

Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
16 Per	4.3	F0	2 48 29.5	+38 11 02	γ Hyi	3.2	M0	3 47 43.9	-74 20 26
17 Per	4.7	K5	2 49 28.5	+34 55 30	g Eri	4.2	K0	3 48 13.1	-36 17 58
ν Hyi	4.7	K2	2 50 39.9	-75 12 06	ζ Per	2.9	B1	3 52 03.2	+31 47 13
τ Per	4.1	G0, A5	2 51 54.3	+52 37 44	ε Per	3.0	B1	3 55 38.0	+39 54 59
η Eri	4.0	K0	2 54 48.8	- 9 01 43	γ Eri	3.2	K5	3 56 29.3	-13 36 05
π Per	4.6	A2	2 56 38.6	+39 31 55	ξ Per	4.0	Oe5	3 56 49.1	+35 41 52
θ Eri	3.4	A2	2 57 00.5	-40 26 10	δ Ret	4.4	M0	3 58 13.1	-61 29 35
ε Ari	4.6	A2	2 57 19.2	+21 12 34	36 Eri	4.7	A0 _p	3 58 31.0	-24 06 32
λ Cet	4.7	B5	2 57 56.6	+ 8 46 37	λ Tau	3.9	B3	3 58 50.9	+12 23 54
α Cet	2.8	M0	3 00 33.1	+ 3 57 41	γ Ret	4.5	M5	4 00 24.9	-62 15 04
τ ³ Eri	4.2	A3	3 00 56.1	-23 45 10	ν Tau	3.9	A0	4 01 23.9	+ 5 53 57
γ Per	3.1	F5, A3	3 02 23.6	+53 22 43	37 Tau	4.5	K0	4 02 44.4	+21 59 35
ρ Per	3-4	M3	3 03 03.3	+38 42 49	λ Per	4.3	A0	4 04 07.0	+50 15 49
β Per	2-3	B8	3 06 00.8	+40 49 47	48 Per	4.0	B3 _p	4 06 15.5	+47 37 34
ι Per	4.2	G0	3 06 40.4	+49 29 20	ο ¹ Eri	4.1	F2	4 10 15.2	- 6 55 21
κ Per	4.0	K0	3 07 15.7	+44 44 01	μ Per	4.3	G0	4 12 28.0	+48 19 38
δ Ari	4.5	K0	3 09 44.3	+19 36 11	α Hor	3.8	K0	4 12 54.4	-42 22 30
α For	3.9	F8	3 10 40.1	-29 06 59	40 Eri	4.5	G5	4 13 45.1	- 7 42 11
16 Eri	3.9	M3	3 18 02.9	-21 52 37	μ Tau	4.3	B3	4 13 44.4	+ 8 48 40
+28°516	4.7	K5	3 18 20.3	+28 55 48	α Ret	3.4	G5	4 13 59.7	-62 33 22
82 G. Eri	4.3	G5	3 18 36.7	-43 11 42	γ Dor	4.4	F5	4 15 09.6	-51 34 09
α Per	1.9	F5	3 21 57.4	+49 44 43	ε Ret	4.4	K2	4 15 54.6	-59 22 51
ο Tau	3.8	G5	3 23 02.1	+ 8 54 50	b Per	4.6	A2	4 15 45.3	+50 12 58
ξ Tau	3.7	B8	3 25 22.6	+ 9 37 08	41 Eri	3.6	B9	4 16 38.7	-33 52 41
2 H. Cam	4.4	B9 _p	3 26 22.8	+59 49 38	γ Tau	3.9	K0	4 17 54.7	+15 32 58
34 Per	4.7	B5	3 26 59.9	+49 23 46	δ Tau	3.9	K0	4 21 01.7	+17 27 59
σ Per	4.5	K0	3 28 14.3	+47 52 58	43 Eri	4.1	K5	4 22 47.7	-34 05 33
5 Tau	4.3	K0	3 29 02.9	+12 49 29	κ Tau	4.4	A3	4 23 23.9	+22 13 11
ε Eri	3.8	K0	3 31 22.4	- 9 34 08	68 Tau	4.2	A2	4 23 34.6	+17 51 14
τ ⁵ Eri	4.3	B8	3 32 19.7	-21 44 33	ν Tau	4.4	A5	4 24 19.8	+22 44 25
ψ Per	4.3	B5 _p	3 34 08.1	+48 05 04	71 Tau	4.6	A5	4 24 27.8	+15 32 41
10 Tau	4.4	G5	3 35 11.2	+ 0 17 53	77 Tau	4.0	K0	4 26 41.2	+15 53 25
y Eri	4.6	K0	3 35 54.5	-40 22 56	ε Tau	3.6	K0	4 26 41.2	+19 06 31
δ Per	3.1	B5	3 40 34.0	+47 41 01	θ ² Tau	3.6	F0	4 26 46.5	+15 47 57
h Eri	4.6	K2	3 41 36.6	-37 25 01	ρ Tau	4.7	A5	4 31 58.4	+14 46 35
δ Eri	3.7	K0	3 41 39.9	- 9 52 27	50 Eri	4.6	K0	4 32 12.9	-29 49 56
ο Per	3.9	B1	3 42 14.6	+32 11 06	α Dor	3.5	A0 _p	4 33 16.9	-55 06 46
17 Tau	3.8	B5 _p	3 42 54.7	+24 00 39	88 Tau	4.4	A3	4 33 50.3	+10 05 40
ν Per	3.9	F5	3 42 56.7	+42 28 33	α Tau	1.1	K5	4 34 01.5	+16 26 40
19 Tau	4.4	B5	3 43 14.4	+24 21 54	ν Eri	3.9	K0	4 34 16.0	-30 37 44
β Ret	3.8	K0	3 43 46.7	-64 54 38	58 Per	4.5	K0, A3	4 34 23.9	+41 11 55
20 Tau	4.0	B5	3 43 51.5	+24 15 57	ν Eri	4.1	B2	4 34 40.1	- 3 25 07
23 Tau	4.2	B5	3 44 21.8	+23 50 49	90 Tau	4.3	A3	4 36 18.6	+12 26 46
π Eri	4.6	M2	3 44 34.8	-12 12 15	53 Eri	4.0	K0	4 36 40.1	-14 22 03
τ ⁶ Eri	4.3	F8	3 45 25.6	-23 20 46	54 Eri	4.5	M4	4 38 59.8	-19 44 02
η Tau	3.0	B5 _p	3 45 31.1	+24 00 16	α Cae	4.5	F2	4 39 29.8	-41 55 34
+65°369	4.7	M1	3 46 28.7	+65 25 34	τ Tau	4.3	B5	4 40 15.7	+22 53 43
γ Cam	4.7	A0	3 46 50.6	+71 13 59	μ Eri	4.2	B5	4 43 51.0	- 3 18 50
27 Tau	3.8	B8	3 47 11.7	+23 57 14	π ³ Ori	3.3	F8	4 48 02.8	+ 6 54 18

FOR JANUARY 1^d.041

Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
2 Ori	4.3	A0	4 48 48.7	+ 8 50 42	ε Ori	1.7	B0	5 34 32.3	- 1 13 18
π ¹ Ori	3.8	B3	4 49 26.8	+ 5 33 00	40 Ori	4.4	K0	5 35 05.5	+ 9 16 27
α Cam	4.4	B0	4 50 45.4	+66 17 21	ζ Tau	3.0	B3p	5 35 40.3	+21 07 26
ω Eri	4.4	F0	4 51 16.3	- 5 30 24	σ Ori	3.8	B0	5 37 05.3	- 2 37 04
π ⁵ Ori	3.9	B3	4 52 31.8	+ 2 23 17	ω Ori	4.5	B3p	5 37 26.5	+ 4 06 15
7 Ori	4.7	A0	4 53 04.6	+10 05 59	α Col	2.7	B5p	5 38 27.2	-34 05 27
9 Ori	4.3	K0	4 54 30.8	+13 27 49	ζ Ori	2.0	B0	5 39 05.6	- 1 57 31
7 Cam	4.4	A2	4 54 38.1	+53 42 05	γ Lep	3.8	F8	5 43 05.2	-22 27 29
ι Aur	2.9	K2	4 54 50.5	+33 06 56	δ Dor	4.5	A5	5 44 42.8	-65 44 52
10 Ori	4.7	K0	4 56 50.2	+ 1 39 53	ζ Lep	3.7	A2	5 45 27.5	-14 49 59
ε Aur	3-4	F5p	4 59 35.8	+43 46 35	κ Ori	2.2	B0	5 46 11.4	- 9 40 48
ζ Aur	3.9	K0, B1	5 00 10.1	+41 01 46	β Pic	3.9	A3	5 46 30.1	-51 04 40
β Cam	4.2	G0p	5 00 28.5	+60 23 47	τ Aur	4.6	K0	5 46 53.2	+39 10 18
ι Tau	4.7	A5	5 01 07.2	+21 32 40	γ Pic	4.4	K0	5 49 13.6	-56 10 27
11 Ori	4.6	B9	5 02 40.9	+15 21 35	ν Aur	4.2	K0	5 49 12.1	+39 08 27
γ Cae	4.6	K0	5 03 13.1	-35 31 39	β Col	3.2	K0	5 49 47.7	-35 46 48
ε Lep	3.3	K5	5 04 03.8	-22 24 51	δ Lep	3.9	K0	5 49 54.1	-20 52 50
η Aur	3.3	B3	5 04 11.8	+41 11 30	136 Tau	4.5	A0	5 51 15.1	+27 36 22
β Eri	2.9	A3	5 06 13.6	- 5 07 40	χ Ori	4.6	F8	5 52 25.6	+20 16 18
λ Eri	4.3	B2	5 07 34.0	- 8 47 42	α Ori	0-1	M0	5 53 23.1	+ 7 24 08
ι Lep	4.5	B8	5 10 45.4	-11 54 27	-63°498	4.5	K0	5 53 50.8	-63 05 59
μ Lep	3.3	A0p	5 11 26.9	-16 14 36	η Lep	3.8	F0	5 54 54.1	-14 10 21
ρ Ori	4.6	K0	5 11 33.9	+ 2 49 24	γ Col	4.4	B3	5 56 22.0	-35 17 09
κ Lep	4.5	B8	5 11 42.4	-12 58 45	δ Aur	3.9	K0	5 56 48.6	+54 17 04
β Ori	0.3	B8p	5 12 57.1	- 8 14 19	β Aur	2.1	A0p	5 57 06.4	+44 56 46
α Aur	0.2	G0	5 14 14.9	+45 57 59	θ Aur	2.7	A0p	5 57 28.2	+37 12 43
τ Ori	3.7	B5	5 16 00.2	- 6 52 43	π Aur	4.6	M3	5 57 29.1	+45 56 09
λ Lep	4.3	B1	5 18 03.2	-13 12 35	η Col	4.0	K0	5 58 08.1	-42 48 59
-21°1135	4.7	A0	5 19 02.3	-21 16 18	-3°1256	4.7	K0	5 58 24.2	- 3 04 27
22 Ori	4.6	B3	5 20 04.6	- 0 24 49	μ Ori	4.2	A2	6 00 34.0	+ 9 38 56
29 Ori	4.2	K0	5 22 21.4	- 7 50 13	62 Ori	4.7	B2p	6 01 57.6	+20 08 27
η Ori	3.4	B1	5 22 49.0	- 2 25 34	1 Gem	4.3	G5	6 02 06.8	+23 16 00
25 Ori	4.7	B3p	5 23 02.0	+ 1 49 03	θ Lep	4.7	A0	6 04 39.7	-14 55 52
γ Ori	1.7	B2	5 23 21.6	+ 6 19 16	ν Ori	4.4	B2	6 05 41.2	+14 46 26
β Tau	1.8	B8	5 24 12.3	+28 34 53	ξ Ori	4.3	B3	6 10 03.8	+14 13 04
ψ Ori	4.7	B2	5 25 06.4	+ 3 04 07	η Gem	3-4	M0	6 12 53.1	+22 31 05
β Lep	3.0	G0	5 26 49.9	-20 47 05	5 Mon	4.1	K0	6 13 14.7	- 6 15 48
32 Ori	4.3	B3	5 29 01.0	+ 5 55 28	κ Aur	4.4	K0	6 13 16.5	+29 30 43
ε Col	3.9	K0	5 30 02.4	-35 29 38	κ Col	4.5	K0	6 15 22.6	-35 07 43
119 Tau	4.7	M2	5 30 16.6	+18 34 17	22 H. Cam	4.7	A0	6 15 12.8	+69 20 04
δ Ori	2.5	B0	5 30 19.2	- 0 19 20	2 Lyn	4.4	A0	6 16 42.8	+59 01 31
ν Ori	4.6	B3	5 30 20.0	- 7 19 28	ζ C Ma	3.1	B3	6 19 02.7	-30 02 52
α Lep	2.7	F0	5 31 16.4	-17 50 41	δ Col	4.0	G5	6 20 54.4	-33 25 08
φ ¹ Ori	4.5	B0	5 33 00.5	+ 9 28 07	μ Gem	3.2	M0	6 20 57.8	+22 31 56
β Dor	4-6	F5p	5 33 20.2	-62 30 41	β C Ma	2.0	B1	6 21 14.8	-17 56 18
λ Ori	3.7	Oe5	5 33 19.1	+ 9 54 48	ε Mon	4.5	A5	6 22 01.1	+ 4 36 40
-6°1234	4.7	B1	5 33 25.8	- 6 01 21	α Car	-0.9	F0	6 23 13.1	-52 40 38
42 Ori	4.6	B3	5 33 45.4	- 4 51 31	λ C Ma	4.5	B5	6 26 56.7	-32 33 30
ι Ori	2.9	Oe5	5 33 49.1	- 5 55 49	ν Gem	4.1	B5	6 27 00.2	+20 14 04

FOR JANUARY 1^d.041

Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
β Mon	4.6	B2e	6 27 12.9	- 7 00 38	21 Lyn	4.4	A0	7 24 13.8	+49 16 44
4 C Ma	4.3	B1	6 30 28.8	-23 23 37	β C Mi	3.1	B8	7 25 21.7	+ 8 21 26
13 Mon	4.5	A0p	6 31 07.2	+ 7 21 31	γ C Mi	4.6	K0	7 26 22.0	+ 8 59 38
ξ^2 C Ma	4.5	A0	6 33 40.3	-22 56 15	ρ Gem	4.2	F0	7 26 59.5	+31 51 06
N Car	4.4	A0	6 34 14.9	-52 56 53	σ Pup	3.3	K5	7 28 11.0	-43 14 02
ν C Ma	4.1	K0	6 35 14.6	-19 13 36	α Gem	1.6	A0	7 32 29.7	+31 57 43
γ Gem	1.9	A0	6 35 48.4	+16 25 44	108 G. Pup	4.5	F8	7 32 38.4	-22 13 26
8 C Ma	4.6	K0	6 36 26.3	-18 12 28	ν Gem	4.2	K5	7 33 53.5	+26 58 14
ν Pup	3.2	B8	6 36 45.0	-43 09 58	p Pup	4.5	B8	7 34 03.3	-28 17 44
S Mon	4.7	Oe5	6 39 09.6	+ 9 55 40	f Pup	4.6	B8	7 36 08.8	-34 53 36
ϵ Gem	3.2	G5	6 41 54.2	+25 09 55	m Pup	4.6	B8	7 36 55.6	-25 17 20
30 Gem	4.6	K0	6 42 07.6	+13 15 46	k Pup	4.5	B8	7 37 28.2	-26 43 33
ξ Gem	3.4	F5	6 43 26.3	+12 55 58	α C Mi	0.5	F5	7 37 34.5	+ 5 18 39
α C Ma	-1.6	A0	6 43 41.7	-16 40 10	α Mon	4.1	K0	7 39 40.2	- 9 28 23
18 Mon	4.7	K0	6 46 08.4	+ 2 26 59	σ Gem	4.3	K0	7 41 15.1	+28 57 54
α Pic	3.3	A5	6 47 51.2	-61 54 20	ζ Vol	3.9	K0	7 42 14.3	-72 31 38
κ C Ma	3.8	B2p	6 48 36.5	-32 28 10	3 Pup	4.1	A2p	7 42 28.9	-28 52 30
τ Pup	2.8	K0	6 49 07.0	-50 34 29	κ Gem	3.7	G5	7 42 27.5	+24 28 43
A Car	4.4	G5	6 49 08.3	-53 34 59	β Gem	1.2	K0	7 43 18.0	+28 06 27
θ Gem	3.6	A2	6 50 36.9	+34 00 10	c Pup	3.7	K5	7 44 04.7	-37 53 16
15 C Ma	4.7	B1	6 52 07.3	-20 10 56	o Pup	4.6	B2	7 46 42.8	-25 51 15
θ C Ma	4.2	K2	6 52 39.4	-11 59 46	Q Pup	4.6	K0	7 47 21.3	-46 59 37
16 C Ma	4.1	K2p	6 52 45.7	-24 08 30	ξ Pup	3.5	G0p	7 47 54.3	-24 46 33
38 Gem	4.7	F0	6 52 47.0	+13 13 16	P Pup	4.2	B0	7 48 13.9	-46 17 22
π C Ma	4.6	F5	6 54 11.5	-20 05 36	a Pup	3.8	G5	7 51 04.9	-40 29 24
15 Lyn	4.5	G0	6 54 25.5	+58 28 06	b Pup	4.5	B3	7 51 28.5	-38 46 36
ι C Ma	4.4	B5	6 54 39.9	-17 00 37	J Pup	4.3	B1	7 52 20.0	-48 00 59
24 H. Cam	4.7	K5	6 55 17.0	+77 01 24	11 Pup	4.3	F8	7 55 26.4	-22 47 28
ϵ C Ma	1.6	B1	6 57 19.7	-28 55 34	χ Car	3.6	B3	7 55 56.4	-52 53 35
σ C Ma	3.7	K5	7 00 24.3	-27 53 12	V Pup	4-5	B1p	7 57 17.4	-49 09 17
σ^2 C Ma	3.1	B5p	7 01 38.8	-23 47 03	232 G. Pup	4.6	A2	7 58 23.3	-18 18 28
ζ Gem	3.9	G0p	7 02 09.2	+20 37 13	+2° 1854	4.5	K0	8 00 32.9	+ 2 25 35
γ C Ma	4.1	B5	7 02 15.9	-15 35 00	ζ Pup	2.3	Od	8 02 25.4	-39 54 34
δ C Ma	2.0	F8p	7 07 02.9	-26 20 23	ρ Pup	2.9	F5	8 06 08.3	-24 12 29
γ^2 Vol	3.9	K0	7 09 02.1	-70 26 44	ζ Mon	4.4	G0	8 06 56.1	- 2 53 12
τ Gem	4.5	K0	7 09 02.4	+30 18 03	16 Pup	4.3	B3	8 07 33.2	-19 08 51
δ Mon	4.1	A0	7 10 10.7	- 0 26 12	ϵ Vol	4.5	B5	8 07 49.9	-68 31 13
I Pup	4.5	F0	7 11 37.1	-46 42 13	γ^2 Vel	1.9	Oap	8 08 30.9	-47 14 19
L ² Pup	3-6	M5e	7 12 31.8	-44 35 07	19 Pup	4.7	K0	8 09 43.4	-12 49 41
27 C Ma	4.7	B5p	7 12 54.4	-26 17 40	h^1 Pup	4.4	K5	8 10 10.7	-39 31 10
ω C Ma	3.8	B3p	7 13 28.3	-26 42 52	h^2 Pup	4.4	K0	8 12 52.5	-40 14 47
π Pup	2.7	K5	7 15 58.6	-37 02 14	β Cnc	3.8	K2	8 14 43.6	+ 9 17 19
λ Gem	3.6	A2	7 16 11.9	+16 36 05	q Pup	4.4	A5	8 17 19.2	-36 33 23
δ Vol	4.0	F5	7 16 51.1	-67 53 49	α Cha	4.1	F5	8 19 24.4	-76 48 57
ν Pup	4.7	B3	7 17 08.0	-36 40 23	31 Lyn	4.4	K5	8 20 35.0	+43 17 44
30 C Ma	4.4	Oe5	7 17 20.3	-24 53 35	θ Cha	4.3	K0	8 21 39.9	-77 22 43
δ Gem	3.5	F0	7 18 09.2	+22 02 41	ϵ Car	1.7	K0, B	8 21 50.3	-59 24 10
η C Ma	2.4	B5p	7 22 47.4	-29 14 16	Br. 1197	3.9	A0	8 24 00.7	- 3 47 52
ι Gem	3.9	K0	7 23 40.8	+27 51 55	β Vol	3.6	K0	8 25 23.1	-66 01 36

FOR JANUARY 1^d.041

Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
o U Ma	3.5	G0	8 27 32.3	+60 49 49	23 U Ma	3.7	F0	9 28 56.8	+63 12 27
δ Hya	4.2	A0	8 35 54.6	+ 5 49 11	ψ Vel	3.6	F5	9 29 23.9	-40 19 18
e Vel	4.1	A5	8 36 29.0	-42 52 23	λ Leo	4.5	K5	9 29 50.4	+23 06 52
σ Hya	4.5	K0	8 37 02.0	+ 3 27 30	N Vel	3.0	K5	9 30 13.1	-56 53 18
β Pyx	4.0	G5	8 38 48.6	-35 11 25	32 Hya	4.5	A3	9 30 18.0	- 1 02 18
o Vel	3.7	B3	8 39 20.9	-52 48 15	θ U Ma	3.3	F8 _p	9 30 39.6	+51 49 44
53 G. Vel	4.1	F5 _p	8 39 31.8	-46 31 51	R Car	4-10	M5 _e	9 31 24.9	-62 38 32
d Car	4.4	B2	8 39 53.4	-59 38 35	24 U Ma	4.6	G0	9 31 35.8	+69 58 36
γ Cnc	4.7	A0	8 41 22.7	+21 35 18	10 L Mi	4.6	G5	9 32 12.4	+36 32 42
η Hya	4.3	B3	8 41 30.0	+ 3 31 05	26 U Ma	4.6	A0	9 32 34.4	+52 11 57
31 Mon	4.7	G0	8 42 03.2	- 7 06 50	1 H. Dra	4.6	K2	9 32 31.5	+81 28 28
α Pyx	3.7	B2	8 42 15.9	-33 04 00	h Car	4.2	B5	9 33 29.2	-59 04 55
δ Cnc	4.2	K0	8 42 48.7	+18 16 36	M Vel	4.5	A5	9 35 38.7	-49 12 24
d Vel	4.1	G5	8 43 13.2	-42 31 44	ι Hya	4.1	K0	9 38 10.3	- 0 59 32
δ Vel	2.0	A0	8 43 47.6	-54 35 13	m Car	4.7	B9	9 38 26.1	-61 10 42
ι Cnc	4.2	G5	8 44 42.2	+28 52 55	o Leo	3.8	F5, A3	9 39 23.4	+10 02 36
12 Hya	4.4	G5	8 44 49.0	-13 25 34	I Hya	4.7	B2 _p	9 39 46.6	-23 26 27
a Vel	4.1	A0	8 44 54.5	-45 55 13	ε Leo	3.1	G0 _p	9 43 58.9	+23 55 37
ε Hya	3.5	F8	8 45 01.8	+ 6 32 27	l Car	4-5	G0	9 44 20.4	-62 21 19
f Car	4.6	B3	8 45 51.4	-56 38 53	v Car	3.1	F0	9 46 16.7	-64 55 06
ρ Hya	4.4	A0	8 46 41.1	+ 5 57 38	v U Ma	3.9	F0	9 48 39.5	+59 11 42
γ Pyx	4.2	K2	8 49 07.9	-27 35 12	39 Hya	4.3	K0	9 49 53.4	-14 41 28
ξ Hya	3.3	K0	8 53 39.0	+ 6 04 20	φ U Ma	4.5	A2	9 49 52.4	+54 13 10
c Car	4.0	B8	8 54 18.1	-60 31 05	m Vel	4.6	G5	9 50 24.1	-46 23 33
α Cnc	4.3	A3	8 56 41.0	+11 59 11	μ Leo	4.1	K0	9 50 53.4	+26 09 47
ι U Ma	3.1	A5	8 56 57.4	+48 10 21	φ Vel	3.7	B5	9 55 42.1	-54 24 37
10 U Ma	4.1	F5	8 58 30.3	+41 54 53	ν ² Hya	4.7	B8	10 03 31.0	-12 54 15
91 G. Vel	4.4	F8	8 58 51.4	-41 07 28	21 L Mi	4.5	A5	10 05 29.3	+35 24 23
κ U Ma	3.7	A0	9 01 22.8	+47 17 18	η Leo	3.6	A0 _p	10 05 32.1	+16 55 27
α Vol	4.2	A5	9 01 55.8	-66 15 51	31 Leo	4.6	K2	10 06 09.3	+10 09 36
c Vel	3.7	K0	9 03 00.9	-46 57 57	15 Sex	4.5	A0	10 06 14.9	- 0 12 35
Pi.8 ^b 245	4.7	G5	9 04 26.2	+38 35 07	α Leo	1.3	B8	10 06 37.0	+12 07 45
G Car	4.5	F5	9 05 04.6	-72 28 12	λ Hya	3.8	K0	10 08 58.7	-12 11 25
15 U Ma	4.5	A3 _p	9 06 33.2	+51 44 20	ω Car	3.6	B8	10 12 57.4	-69 52 26
λ Vel	2.2	K5	9 06 46.8	-43 17 55	q Vel	4.1	A2	10 13 20.8	-41 57 29
τ U Ma	4.7	F5, A5	9 08 13.0	+63 38 57	ξ Leo	3.6	F0	10 14 51.5	+23 34 56
a Car	3.6	B3	9 10 05.9	-58 49 53	λ U Ma	3.5	A2	10 15 06.8	+43 04 47
i Car	4.2	B3	9 10 31.8	-62 10 53	187 G. Car	3.4	K5	10 15 58.7	-61 10 01
θ Hya	3.8	A0	9 12 38.9	+ 2 27 16	γ ¹ Leo	2.6	K0	10 18 09.3	+20 00 33
β Car	1.8	A0	9 12 50.8	-69 34 52	-54°3474	4.6	K0	10 18 22.2	-54 51 48
k Vel	4.7	F5	9 14 25.8	-37 16 30	J Vel	4.6	B5 _p	10 19 40.9	-55 52 36
g Car	4.2	K5	9 15 16.2	-57 24 10	μ U Ma	3.2	K5	10 20 22.2	+41 39 58
ι Car	2.2	F0	9 16 12.4	-59 08 11	I Car	4.1	F5	10 23 44.7	-73 51 48
38 Lyn	3.8	A2	9 16 47.8	+36 56 36	μ Hya	4.1	K5	10 24 29.6	-16 40 02
α Lyn	3.3	K5	9 19 03.0	+34 31 59	α Ant	4.4	K5	10 25 38.4	-30 53 57
κ Vel	2.6	B3	9 21 05.5	-54 52 09	β L Mi	4.4	K0	10 25 58.8	+36 52 37
κ Leo	4.6	K0	9 22 44.2	+26 19 31	s Car	4.1	F0	10 26 39.8	-58 34 14
α Hya	2.2	K2	9 25 57.9	- 8 30 53	p Car	3.6	B5 _p	10 30 50.8	-61 30 55
ε Ant	4.6	K2	9 27 52.9	-35 48 23	ρ Leo	3.8	B0 _p	10 31 04.5	+ 9 28 37

FOR JANUARY 1^d.041

Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
<i>r</i> Car	4.5	K5	10 34 19.0	-57 23 11	γ U Ma	2.5	A0	11 52 06.1	+53 52 41
γ Cha	4.1	M0	10 35 05.7	-78 26 11	π Vir	4.6	A3	11 59 10.9	+ 6 47 54
<i>p</i> Vel	4.1	F2, A3	10 35 54.6	-48 03 14	θ Cru	4.5	A5	12 01 20.0	-63 07 45
<i>t</i> Car	4.7	K5	10 37 29.4	-59 00 39	\circ Vir	4.2	G5	12 03 31.7	+ 8 54 58
<i>x</i> Vel	4.4	G0	10 37 59.3	-55 25 52	η Cru	4.3	F0	12 05 08.8	-64 25 47
θ Car	3.0	B0	10 41 46.5	-64 13 16	δ Cen	2.9	B3 _p	12 06 38.4	-50 32 20
<i>w</i> Car	4.5	K5	10 42 16.5	-60 23 36	α Crv	4.2	F2	12 06 42.4	-24 32 42
μ Vel	2.8	G5	10 45 20.7	-49 14 44	ϵ Crv	3.2	K0	12 08 25.4	-22 26 11
δ^2 Cha	4.6	B3	10 45 29.9	-80 21 58	ρ Cen	4.2	B3	12 09 55.1	-52 11 06
ν Hya	3.3	K0	10 47 59.7	-16 01 14	δ Cru	3.1	B3	12 13 22.9	-58 33 56
46 L Mi	3.9	K0	10 51 28.3	+34 23 35	δ U Ma	3.4	A2	12 13 48.0	+57 12 57
<i>u</i> Car	3.9	K0	10 52 08.8	-58 40 40	γ Crv	2.8	B8	12 14 06.3	-17 21 32
54 Leo	4.5	A0	10 53 49.8	+24 55 34	ϵ Mus	4.2	M4	12 15 46.3	-67 46 38
ι Ant	4.7	K0	10 55 10.6	-36 57 36	β Cha	4.4	B5	12 16 22.5	-79 07 45
α Crt	4.2	K0	10 58 09.9	-18 07 22	ζ Cru	4.3	B3	12 16 38.0	-63 49 12
239 G. Vel	4.6	A2	10 58 38.1	-42 02 55	η Vir	4.0	A0	12 18 13.0	- 0 29 01
β U Ma	2.4	A0	10 59 51.7	+56 33 35	ϵ Cru	3.6	K2	12 19 34.0	-60 13 09
60 Leo	4.4	A0	11 00 34.2	+20 21 25	α^1 Cru	1.0	B1	12 24 44.9	-62 54 59
α U Ma	1.9	K0	11 01 42.4	+61 55 46	γ Com	4.6	K0	12 25 17.7	+28 27 06
χ Leo	4.7	F0	11 03 18.9	+ 7 30 53	σ Cen	4.2	B3	12 26 14.8	-50 02 53
260 G. Car	4.0	F8 _p	11 07 10.4	-58 47 46	δ Crv	3.1	A0	12 28 09.2	-16 19 55
ψ U Ma	3.1	K0	11 07 48.9	+44 40 40	γ Cru	1.6	M3	12 29 19.4	-56 55 43
β Crt	4.5	A2	11 10 01.9	-22 38 43	η Crv	4.4	F0	12 30 22.0	-16 00 49
<i>y</i> Car	4.7	F5 _p	11 11 10.7	-60 08 16	γ Mus	4.0	B5	12 30 28.4	-71 57 03
δ Leo	2.6	A3	11 12 21.3	+20 42 17	κ Dra	3.9	B5 _p	12 32 05.0	+69 58 11
θ Leo	3.4	A0	11 12 30.6	+15 36 36	β C Vn	4.3	G0	12 32 10.7	+41 32 11
ϕ Leo	4.6	A5	11 14 59.0	- 3 28 16	β Crv	2.8	G5	12 32 39.0	-23 12 52
ξ U Ma	3.9	G0	11 16 25.5	+31 42 54	α Mus	2.9	B3	12 35 11.8	-68 57 14
ν U Ma	3.7	K0	11 16 42.0	+33 16 28	τ Cen	4.0	A2	12 35 53.3	-48 21 36
δ Crt	3.8	K0	11 17 41.3	-14 35 59	γ Cen	2.4	A0	12 39 41.2	-48 46 44
σ Leo	4.1	A0	11 19 26.1	+ 6 12 37	γ Vir	2.9	F0	12 39 59.1	- 1 16 08
π Cen	4.3	B5	11 19 29.7	-54 18 36	<i>w</i> Cen	4.6	K0	12 40 45.2	-48 37 56
ι Leo	4.0	F5	11 22 12.3	+10 42 40	ι Cru	4.7	K0	12 43 40.6	-60 48 02
γ Crt	4.1	A5	11 23 13.8	-17 30 09	β Mus	3.3	B3	12 44 14.3	-67 55 41
λ Dra	4.1	M0	11 29 27.9	+69 30 48	β Cru	1.5	B1	12 45 46.8	-59 30 31
ξ Hya	3.7	G5	11 31 22.5	-31 40 30	ϵ Cen	4.3	K2	12 51 14.2	-48 45 51
λ Cen	3.3	B9	11 34 15.0	-62 50 14	<i>n</i> Cen	4.3	A5	12 51 36.1	-39 59 59
ν Leo	4.5	K0	11 35 15.5	- 0 38 29	ϵ U Ma	1.7	A0 _p	12 52 34.9	+56 08 19
λ Mus	3.8	A5	11 44 02.3	-66 32 45	μ Cru	4.3	B3	12 52 38.5	-56 59 57
ν Vir	4.2	M0	11 44 09.8	+ 6 42 52	δ Vir	3.7	M0	12 53 56.4	+ 3 34 35
χ U Ma	3.8	K0	11 44 18.8	+47 57 44	α^2 C Vn	2.9	A0 _p	12 54 29.2	+38 29 46
65 G. Cen	4.2	G0	11 44 54.4	-60 59 42	δ Mus	3.6	K2	12 59 58.4	-71 22 17
93 Leo	4.5	F8	11 46 17.1	+20 24 08	ϵ Vir	2.9	K0	13 00 32.0	+11 08 10
μ Mus	4.7	K5	11 46 38.5	-66 37 53	ξ^2 Cen	4.4	B3	13 04 58.4	-49 43 48
β Leo	2.2	A2	11 47 22.6	+14 45 23	θ Vir	4.5	A0	13 08 14.3	- 5 21 48
<i>j</i> Cen	4.5	B5	11 48 04.0	-63 36 18	α Com	4.5	F5	13 08 22.9	+17 42 12
β Vir	3.8	F8	11 48 58.5	+ 1 57 02	β Com	4.3	G0	13 10 20.0	+28 02 42
B Cen	4.7	K0	11 49 29.2	-44 59 23	20 C Vn	4.7	F0	13 16 03.9	+40 44 45
β Hya	4.4	B9	11 51 14.2	-33 43 28	γ Hya	3.3	G5	13 17 07.4	-22 59 53

FOR JANUARY 1^d.041

Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
<i>ι</i> Cen	2.9	A2	13 18 44.1	-36 32 20	<i>σ</i> Lup	4.6	B2	14 30 22.8	-50 18 43
<i>J</i> Cen	4.6	B5	13 20 29.0	-60 48 57	<i>γ</i> Boo	3.0	F0	14 30 44.9	+38 27 06
<i>m</i> Cen	4.5	G0	13 21 46.3	-64 21 50	<i>σ</i> Boo	4.5	F0	14 33 14.6	+29 53 15
<i>ζ</i> U Ma	2.4	A2 _p	13 22 36.0	+55 05 50	<i>η</i> Cen	2.6	B3 _p , A2 _p	14 33 24.2	-42 00 50
<i>α</i> Vir	1.2	B2	13 23 27.1	-10 59 23	<i>ρ</i> Lup	4.1	B5	14 35 39.3	-49 16 59
80 U Ma	4.0	A5	13 23 54.4	+55 09 34	<i>α</i> Cen	0.1	G0	14 37 20.7	-60 42 01
<i>R</i> Hya	3-10	M7 _e	13 27 54.3	-23 06 41	<i>ζ</i> Boo	3.9	A2	14 39 34.3	+13 52 08
<i>d</i> Cen	4.0	K0	13 29 07.4	-39 14 15	<i>α</i> Lup	2.9	B2	14 39 43.5	-47 14 52
<i>ζ</i> Vir	3.4	A2	13 33 00.6	- 0 25 40	<i>α</i> Cir	3.4	F0	14 39 49.1	-64 49 59
24 C Vn	4.6	A3	13 33 06.5	+49 11 03	<i>b</i> Cen	4.1	B3	14 39 54.1	-37 39 11
<i>ε</i> Cen	2.6	B1	13 37 47.1	-53 17 57	<i>μ</i> Vir	3.9	F5	14 41 19.1	- 5 30 57
83 U Ma	4.7	M2	13 39 29.3	+54 50 53	371 G. Cen	4.1	K0	14 41 37.9	-35 01 58
1 Cen	4.4	F5	13 43 48.3	-32 52 39	<i>ε</i> Boo	2.7	K0	14 43 32.7	+27 12 45
<i>M</i> Cen	4.7	K0	13 44 33.3	-51 16 05	<i>ο</i> Boo	4.7	K0	14 43 42.0	+17 06 11
<i>τ</i> Boo	4.5	F5	13 45 41.6	+17 37 14	<i>α</i> Aps	3.8	K5	14 43 40.6	-78 54 25
<i>η</i> U Ma	1.9	B3	13 46 14.5	+49 28 39	109 Vir	3.8	A0	14 44 34.7	+ 2 01 51
<i>ν</i> Cen	3.5	B2	13 47 31.0	-41 31 26	58 Hya	4.6	K2	14 48 20.7	-27 49 27
2 Cen	4.4	M6	13 47 31.6	-34 17 12	<i>α</i> ² Lib	2.9	A3	14 49 02.9	-15 54 21
<i>μ</i> Cen	3.3	B2 _p	13 47 37.2	-42 18 36	<i>ο</i> Lup	4.5	B5	14 49 28.6	-43 26 24
<i>ν</i> Boo	4.3	K5	13 47 53.1	+15 57 39	<i>ξ</i> Boo	4.6	G5	14 49 51.9	+19 14 13
3 Cen	4.7	B5	13 49 54.9	-32 49 53	<i>β</i> U Mi	2.2	K5	14 50 46.9	+74 17 25
<i>η</i> Boo	2.8	G0	13 53 06.8	+18 33 45	16 Lib	4.6	F0	14 55 27.4	- 4 12 47
<i>ζ</i> Cen	3.1	B2 _p	13 53 28.2	-47 07 36	<i>β</i> Lup	2.8	B2 _p	14 56 21.6	-43 00 08
294 G. Cen	4.7	K0	13 55 14.4	-63 31 34	<i>κ</i> Cen	3.3	B3	14 57 00.4	-41 58 23
<i>φ</i> Cen	4.0	B3	13 56 15.4	-41 56 25	<i>β</i> Boo	3.6	G5	15 00 42.1	+40 31 11
<i>ν</i> ¹ Cen	4.2	B3	13 56 37.9	-44 38 36	110 Vir	4.6	K0	15 01 13.8	+ 2 13 11
<i>ν</i> ² Cen	4.4	F5	13 59 39.3	-45 26 40	<i>σ</i> Lib	3.4	M3	15 02 08.0	-25 09 13
<i>τ</i> Vir	4.3	A2	13 59 57.9	+ 1 42 12	<i>π</i> Lup	4.0	B5	15 02 51.7	-46 55 24
<i>β</i> Cen	0.9	B1	14 01 28.7	-60 12 53	<i>ψ</i> Boo	4.7	K0	15 03 01.8	+27 04 31
<i>α</i> Dra	3.6	A0 _p	14 03 29.7	+64 31 59	<i>λ</i> Lup	4.4	B3	15 06 36.6	-45 09 15
<i>χ</i> Cen	4.5	B3	14 04 01.4	-41 01 21	<i>κ</i> ¹ Lup	4.1	B9	15 09 37.8	-48 36 50
<i>π</i> Hya	3.5	K0	14 04 29.2	-26 31 27	<i>ζ</i> Lup	3.5	K0	15 09 54.1	-51 58 30
<i>θ</i> Cen	2.3	K0	14 04 44.0	-36 12 30	<i>ι</i> Lib	4.7	A0 _p	15 10 20.1	-19 40 05
<i>κ</i> Vir	4.3	K0	14 11 07.9	-10 07 16	<i>δ</i> Boo	3.5	K0	15 14 10.3	+33 26 13
<i>κ</i> Boo	4.6	A5	14 12 18.1	+51 56 37	<i>β</i> Cir	4.2	A3	15 14 54.9	-58 40 47
<i>α</i> Boo	0.2	K0	14 14 09.3	+19 21 12	<i>β</i> Lib	2.7	B8	15 15 13.7	- 9 15 45
<i>ι</i> Vir	4.2	F5	14 14 16.9	- 5 50 38	2 Lup	4.4	K0	15 15 49.0	-30 01 43
<i>λ</i> Boo	4.3	A0	14 15 07.8	+46 14 21	<i>γ</i> Tr A	3.1	A0	15 15 48.1	-68 33 34
<i>ι</i> Lup	4.1	B3	14 17 16.8	-45 54 24	<i>μ</i> Lup	4.4	B8	15 16 13.6	-47 45 18
<i>λ</i> Vir	4.6	A2	14 17 19.2	-13 13 12	<i>δ</i> Lup	3.4	B2	15 19 11.9	-40 31 46
<i>ν</i> Cen	4.4	B5	14 18 00.3	-56 14 08	<i>φ</i> ¹ Lup	3.6	K5	15 19 42.3	-36 08 35
<i>ψ</i> Cen	4.2	A0	14 18 32.5	-37 44 04	<i>ε</i> Lup	3.7	B3	15 20 25.8	-44 34 20
<i>a</i> Cen	4.5	B5	14 20 59.7	-39 21 44	<i>γ</i> U Mi	3.1	A2	15 20 45.9	+71 57 05
<i>δ</i> Oct	4.1	K2	14 21 24.7	-83 31 09	<i>γ</i> Cir	4.5	B5, F8	15 20 44.0	-59 12 13
<i>θ</i> Boo	4.1	F8	14 24 04.4	+52 00 09	<i>φ</i> ² Lup	4.7	B3	15 21 02.4	-36 44 30
<i>τ</i> ¹ Lup	4.6	B3	14 24 00.5	-45 04 24	<i>μ</i> ¹ Boo	4.5	F0	15 23 14.5	+37 29 31
<i>τ</i> ² Lup	4.5	F8	14 24 02.9	-45 13 53	<i>k</i> Lup	4.7	A0	15 23 11.3	-38 37 05
5 U Mi	4.4	K2	14 27 34.3	+75 50 33	<i>ι</i> Dra	3.5	K0	15 24 11.5	+59 04 52
<i>ρ</i> Boo	3.8	K0	14 30 24.4	+30 30 56	<i>β</i> Cr B	3.7	F0 _p	15 26 28.0	+29 13 06

MEAN PLACES OF STARS, 1967.0

289

FOR JANUARY 1^d.041

Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
θ Cr B	4.2	B5	15 31 35.8	+31 28 10	σ Sco	3.1	B1	16 19 10.7	-25 30 55
γ Lup	2.9	B3	15 32 56.0	-41 03 26	γ Her	3.8	F0	16 20 27.8	+19 13 46
δ Ser	4.2	F0	15 33 13.4	+10 38 53	ξ Cr B	4.7	K0	16 20 48.6	+30 58 03
α Cr B	2.3	A0	15 33 17.4	+26 49 29	ψ Oph	4.6	K0	16 22 10.1	-19 57 42
γ Lib	4.0	K0	15 33 40.6	-14 40 51	η Dra	2.9	G5	16 23 32.4	+61 35 19
ε Tr A	4.1	K0	15 33 40.7	-66 12 30	ω Her	4.5	A0p	16 23 53.4	+14 06 29
ν Lib	3.8	K2	15 35 00.9	-28 01 38	ν Oph	4.7	A2	16 26 00.9	- 8 17 58
ω Lup	4.3	K5	15 35 49.3	-42 27 38	α Sco	1.2	M0, A3	16 27 22.8	-26 21 38
τ Lib	3.8	B3	15 36 37.4	-29 40 15	γ Aps	3.9	K0	16 28 19.8	-78 49 36
ψ Lup	4.6	K0	15 37 39.9	-34 18 20	β Her	2.8	K0	16 28 48.0	+21 33 37
g Lup	4.7	F5	15 38 54.7	-44 33 12	λ Oph	3.8	A0	16 29 14.9	+ 2 03 17
ι Ser	4.5	A2	15 40 04.7	+19 46 32	N Sco	4.3	B3	16 29 13.3	-34 38 03
γ Cr B	3.9	A0	15 41 21.3	+26 23 56	φ Oph	4.4	K0	16 29 14.8	-16 32 32
α Ser	2.7	K0	15 42 38.4	+ 6 31 41	ω Oph	4.6	F0	16 30 10.5	-21 23 51
β Ser	3.7	A2	15 44 39.8	+15 31 26	σ Her	4.2	A0	16 33 02.2	+42 30 15
λ Ser	4.4	G0	15 44 50.4	+ 7 27 19	τ Sco	2.9	B0	16 33 49.4	-28 08 57
ξ U Mi	4.3	A2	15 45 11.9	+77 53 48	H Sco	4.3	M2	16 34 11.9	-35 11 22
κ Ser	4.3	K5	15 47 15.2	+18 14 32	ζ Oph	2.7	B0	16 35 20.3	-10 30 06
μ Ser	3.6	A0	15 47 53.7	- 3 19 50	β Aps	4.2	K0	16 38 19.2	-77 27 07
δ Cr B	4.7	G5	15 48 12.5	+26 10 05	ζ Her	3.0	G0	16 40 02.5	+31 39 41
χ Lup	4.1	B9	15 48 51.3	-33 31 41	η Her	3.6	K0	16 41 45.8	+38 59 02
ε Ser	3.7	A2	15 49 10.1	+ 4 34 33	α Tr A	1.9	K2	16 45 09.2	-68 58 11
χ Her	4.6	G0	15 51 32.0	+42 32 35	η Ara	3.7	K5	16 46 55.6	-58 59 05
2 Sco	4.7	B3	15 51 37.5	-25 13 48	20 Oph	4.7	F5	16 48 00.3	-10 43 34
θ Lib	4.3	K0	15 51 56.5	-16 38 02	ε Sco	2.4	K0	16 48 01.3	-34 14 06
β Tr A	3.0	F0	15 52 13.0	-63 19 51	ε U Mi	4.4	G5	16 49 17.0	+82 05 39
ρ Sco	4.0	B3	15 54 50.5	-29 07 09	μ ¹ Sco	3.1	B3p	16 49 37.8	-37 59 33
γ Ser	3.9	F5	15 54 55.6	+15 46 05	μ ² Sco	3.6	B2	16 50 05.7	-37 57 47
ε Cr B	4.2	K0	15 56 13.2	+26 58 20	ζ Sco	3.7	K5	16 52 15.4	-42 18 24
48 Lib	4.7	B3p	15 56 20.2	-14 11 08	ι Oph	4.3	B8	16 52 26.7	+10 13 06
π Sco	3.0	B2	15 56 51.0	-26 01 14	ζ Ara	3.1	K5	16 55 52.9	-55 56 24
η Lup	3.6	B3	15 57 55.7	-38 18 14	κ Oph	3.4	K0	16 56 06.3	+ 9 25 30
δ Sco	2.5	B0	15 58 22.7	-22 31 45	ε Ara	4.1	K2	16 56 56.8	-53 06 43
η Nor	4.7	G5	16 00 46.7	-49 08 22	ε Her	3.9	A0	16 59 01.5	+30 58 26
θ Dra	4.1	F8	16 01 16.0	+58 39 10	η Oph	2.6	A2	17 08 29.0	-15 41 08
ν Her	4.6	B9	16 01 46.1	+46 07 39	ζ Dra	3.2	B5	17 08 41.2	+65 45 18
ξ Sco	4.2	F8	16 02 33.0	-11 17 01	η Sco	3.4	F2	17 09 47.1	-43 11 51
β ¹ Sco	2.9	B1	16 03 30.8	-19 43 00	α Her	3.5	M3	17 13 08.5	+14 25 36
θ Lup	4.3	B3	16 04 25.1	-36 42 51	δ Her	3.2	A2	17 13 40.5	+24 52 37
ω ¹ Sco	4.1	B2	16 04 52.4	-20 34 53	π Her	3.4	K5	17 13 53.8	+36 50 43
ω ² Sco	4.6	G0	16 05 27.9	-20 46 52	68 Her	4-5	B3	17 16 06.3	+33 08 04
φ Her	4.3	B9p	16 07 43.7	+45 01 14	ζ Aps	4.7	K2	17 18 31.9	-67 44 19
ν Sco	4.3	B3	16 10 04.4	-19 22 35	ν Ser	4.3	A0	17 18 58.1	-12 48 54
13 Sco	4.7	B3	16 10 15.9	-27 50 33	ξ Oph	4.5	F5	17 19 01.4	-21 04 45
δ Tr A	4.0	G0	16 12 25.1	-63 36 13	θ Oph	3.4	B3	17 19 58.8	-24 58 06
δ Oph	3.0	M0	16 12 36.8	- 3 36 39	ρ Her	4.5	A0	17 22 32.6	+37 10 31
ε Oph	3.3	K0	16 16 34.3	- 4 36 49	β Ara	2.8	K2	17 22 33.0	-55 30 04
γ ² Nor	4.1	K0	16 17 21.7	-50 04 35	γ Ara	3.5	B1	17 22 36.6	-56 20 56
τ Her	3.9	B5	16 18 44.8	+46 23 28	44 Oph	4.3	F0	17 24 21.1	-24 08 48

FOR JANUARY 1^d.041

Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
σ Oph	4.4	K0	17 24 52.5	+ 4 10 03	-27°12684	4.7	K5	18 15 59.2	-27 03 22
27 H. Oph	4.6	F0	17 24 52.7	- 5 03 32	κ Lyr	4.3	K0	18 18 42.2	+36 02 55
45 Oph	4.4	F5	17 25 14.7	-29 50 21	δ Sgr	2.8	K0	18 18 52.8	-29 50 38
δ Ara	3.8	B8	17 28 06.8	-60 39 31	η Ser	3.4	K0	18 19 36.0	- 2 54 32
ν Sco	2.8	B3	17 28 31.0	-37 16 17	ξ Pav	4.2	K2	18 20 11.1	-61 30 41
α Ara	3.0	B3p	17 29 17.2	-49 51 08	ϕ Dra	4.2	A0p	18 21 13.9	+71 19 14
λ Her	4.5	K0	17 29 24.2	+26 08 04	χ Dra	3.7	F8	18 21 39.1	+72 43 08
β Dra	3.0	G0	17 29 41.1	+52 19 30	ϵ Sgr	1.9	A0	18 21 58.8	-34 24 08
λ Sco	1.7	B2	17 31 21.9	-37 04 54	109 Her	3.9	K0	18 22 17.4	+21 45 12
σ Ara	4.6	A0	17 33 11.9	-46 29 06	α Tel	3.8	B3	18 24 31.6	-45 59 19
α Oph	2.1	A5	17 33 24.1	+12 34 58	λ Sgr	2.9	K0	18 25 56.0	-25 26 30
Q Sco	4.3	K0	17 34 16.3	-38 36 50	ζ Tel	4.1	K0	18 26 17.3	-49 05 27
θ Sco	2.0	F0	17 34 56.6	-42 58 44	γ Set	4.7	A3	18 27 18.9	-14 35 18
ξ Ser	3.6	A5	17 35 41.7	-15 22 46	θ Cr A	4.7	G5	18 31 08.7	-42 20 17
μ Oph	4.6	B8	17 36 02.9	- 8 06 01	α Set	4.1	K0	18 33 24.6	- 8 16 07
ι Her	3.8	B3	17 38 31.9	+46 01 23	α Lyr	0.1	A0	18 35 49.2	+38 45 07
\circ Ser	4.4	A2	17 39 33.5	-12 51 33	ζ Pav	4.1	K0	18 39 11.3	-71 27 34
κ Sco	2.5	B2	17 40 12.1	-39 00 54	δ Set	4.7	F0	18 40 28.0	- 9 05 08
δ U Mi	4.4	A0	17 42 48.5	+86 36 14	ϵ Lyr	4.5	A5	18 43 17.1	+39 34 38
β Oph	2.9	K0	17 41 50.4	+ 4 34 46	ζ Lyr	4.3	A3	18 43 38.1	+37 34 10
η Pav	3.6	K0	17 42 29.4	-64 42 38	ϕ Sgr	3.3	B8	18 43 35.7	-27 01 35
μ Her	3.5	G5	17 45 09.9	+27 44 20	110 Her	4.3	F5	18 44 14.4	+20 30 49
ι^1 Sco	3.1	F5p	17 45 16.4	-40 06 58	β Set	4.5	G0	18 45 25.3	- 4 47 05
X Sgr	4-5	F5-G0	17 45 28.9	-27 49 12	111 Her	4.4	A3	18 45 33.7	+18 08 36
γ Oph	3.7	A0	17 46 14.2	+ 2 43 06	R Set	4-9	K0p	18 45 43.2	- 5 44 31
G Sco	3.2	K2	17 47 36.6	-37 02 05	β^1 Lyr	3-4	B8p, B2p	18 48 51.6	+33 19 24
ξ Dra	3.9	K0	17 52 57.4	+56 52 38	λ Pav	4.4	B2	18 49 09.8	-62 13 41
θ Her	4.0	K0	17 55 07.2	+37 15 14	σ Sgr	2.1	B3	18 53 13.1	-26 20 22
γ Dra	2.4	K5	17 55 50.3	+51 29 31	δ Lyr	4.5	M4	18 53 20.9	+36 51 21
ξ Her	3.8	K0	17 56 28.9	+29 15 01	113 Her	4.6	G0, A3	18 53 21.2	+22 36 08
ν Her	4.5	F0	17 57 14.3	+30 11 27	κ Pav	4-5	F5p	18 53 33.3	-67 16 39
ν Oph	3.5	K0	17 57 12.5	- 9 46 16	R Lyr	4-5	M3	18 54 19.8	+43 54 06
93 Her	4.7	K0	17 58 35.2	+16 45 06	θ^1 Ser	4.5	A5	18 54 34.7	+ 4 09 33
ζ Ser	4.6	F0	17 58 44.3	- 3 41 23	ξ^2 Sgr	3.6	K0	18 55 45.6	-21 09 06
67 Oph	3.9	B5p	17 58 59.4	+ 2 55 54	γ Lyr	3.3	A0p	18 57 42.5	+32 38 35
68 Oph	4.4	A2	18 00 04.6	+ 1 18 16	ϵ Aql	4.2	K0	18 58 07.4	+15 01 20
W Sgr	4-5	F8p	18 02 54.7	-29 35 00	12 Aql	4.1	K0	18 59 55.0	- 5 47 13
γ Sgr	3.1	K0	18 03 41.2	-30 25 35	ζ Sgr	2.7	A2	19 00 30.7	-29 55 45
70 Oph	4.1	K0	18 03 47.2	+ 2 30 21	\circ Sgr	3.9	K0	19 02 42.3	-21 47 29
θ Ara	3.9	B1p	18 04 03.6	-50 05 45	ζ Aql	3.0	A0	19 03 53.5	+13 48 47
π Pav	4.4	A5	18 05 24.1	-63 40 20	γ Cr A	4.3	F8	19 04 11.3	-37 06 45
71 Oph	4.7	G5	18 05 43.6	+ 8 43 42	λ Aql	3.5	B9	19 04 29.8	- 4 56 00
72 Oph	3.7	A3	18 05 47.0	+ 9 33 28	τ Sgr	3.4	K0	19 04 52.8	-27 43 13
-28°14174	4.7	K0	18 05 59.5	-28 27 45	δ Cr A	4.7	K0	19 06 03.1	-40 32 59
\circ Her	3.8	A0	18 06 15.2	+28 45 25	α Cr A	4.1	A2	19 07 13.7	-37 57 28
102 Her	4.3	B3	18 07 20.7	+20 48 29	β Cr A	4.2	G5	19 07 45.6	-39 23 42
ϵ Tel	4.6	K0	18 08 46.7	-45 57 44	π Sgr	3.0	F2	19 07 48.1	-21 04 40
μ Sgr	4.0	B8p	18 11 47.3	-21 04 09	δ Dra	3.2	K0	19 12 33.1	+67 36 12
η Sgr	3.2	M3	18 15 23.5	-36 46 24	η Lyr	4.5	B3	19 12 38.0	+39 05 18

MEAN PLACES OF STARS, 1967.0

291

FOR JANUARY 1^d.041

Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
1 Vul	4.6	B5	19 14 47.8	+21 19 51	39 Cyg	4.6	K2	20 22 32.4	+32 04 58
θ Lyr	4.5	K0	19 15 13.3	+38 04 26	α Pav	2.1	B3	20 23 02.8	-56 50 33
τ Dra	4.6	K0	19 16 11.8	+73 17 41	41 Cyg	4.1	F5p	20 28 02.7	+30 15 27
κ Cyg	4.0	K0	19 16 20.4	+53 18 25	θ Cep	4.3	A5	20 29 01.8	+62 52 58
ρ Sgr	3.9	A5	19 19 45.5	-17 54 39	ε Del	4.0	B5	20 31 38.1	+11 11 24
ν Sgr	4.6	B8p, F2p	19 19 50.2	-16 01 06	ζ Del	4.7	A2	20 33 45.9	+14 33 34
β ¹ Sgr	4.3	B8	19 20 16.1	-44 31 22	α Ind	3.2	K0	20 35 15.1	-47 24 29
π Dra	4.6	A2	19 20 30.1	+65 39 03	β Del	3.7	F5	20 36 00.0	+14 28 45
β ² Sgr	4.5	F0	19 20 50.2	-44 51 49	71 Aql	4.5	K0	20 36 38.0	- 1 13 18
α Sgr	4.1	B8	19 21 36.1	-40 40 47	α Del	3.9	B8	20 38 06.2	+15 47 40
δ Aql	3.4	F0	19 23 50.0	+ 3 02 51	α Cyg	1.3	A2p	20 40 18.3	+45 09 42
α Vul	4.6	M0	19 27 19.9	+24 35 49	η Ind	4.7	F0	20 41 37.4	-52 02 26
ι Cyg	3.9	A2	19 28 52.4	+51 39 31	δ Del	4.5	A5	20 41 55.0	+14 57 18
β ¹ Cyg	3.2	K0, A0	19 29 23.3	+27 53 21	β Pav	3.6	A5	20 42 00.3	-66 19 25
μ Aql	4.6	K0	19 32 28.6	+ 7 18 27	ψ Cap	4.3	F8	20 44 08.6	-25 23 27
52 Sgr	4.7	B9	19 34 42.0	-24 57 29	52 Cyg	4.3	K0	20 44 17.9	+30 35 54
ι Aql	4.3	B5	19 35 00.8	- 1 21 40	6 H. Cep	4.6	G0	20 44 32.0	+57 27 39
θ Cyg	4.6	F5	19 35 33.3	+50 08 38	η Cep	3.6	K0	20 44 37.2	+61 42 37
α Sge	4.4	G0	19 38 37.2	+17 56 12	ε Cyg	2.6	K0	20 44 52.5	+33 50 45
β Sge	4.4	K0	19 39 33.9	+17 23 54	γ ² Del	4.5	G5	20 45 07.5	+16 00 16
δ Cyg	3.0	A0	19 43 56.5	+45 02 57	ε Aqr	3.8	A0	20 45 53.4	- 9 37 04
γ Aql	2.8	K2	19 44 41.4	+10 31 54	3 Aqr	4.6	M0	20 45 59.7	- 5 08 59
δ Sge	3.8	M0, A0	19 45 54.9	+18 27 06	λ Cyg	4.5	B5	20 46 07.3	+36 22 07
ε Dra	4.0	K0	19 48 17.5	+70 11 02	ω Cap	4.2	M0	20 49 51.3	-27 02 38
α Aql	0.9	A5	19 49 10.3	+ 8 46 48	57 Cyg	4.7	B3	20 52 04.6	+44 15 42
χ Cyg	4-14	M7e	19 49 17.7	+32 49 47	β Ind	3.7	K0	20 52 14.6	-58 34 49
η Aql	3-4	G0p	19 50 47.5	+ 0 55 11	ν Cyg	4.0	A0	20 55 56.4	+41 02 22
13 Vul	4.5	A0	19 52 03.4	+23 59 33	γ Mic	4.7	G5	20 59 16.3	-32 23 17
ι Sgr	4.2	K0	19 52 59.3	-41 57 24	ξ Cyg	3.9	K5	21 03 43.7	+43 47 44
β Aql	3.9	K0	19 53 41.5	+ 6 19 23	θ Cap	4.2	A0	21 04 05.6	-17 21 54
59 Sgr	4.6	K2	19 54 55.4	-27 15 32	A Cap	4.6	M0	21 05 12.0	-25 08 20
η Cyg	4.0	K0	19 55 04.0	+34 59 41	ν Aqr	4.5	K0	21 07 47.8	-11 30 23
ε Pav	4.1	A0	19 56 48.3	-73 00 01	ζ Cyg	3.4	K0	21 11 31.8	+30 05 27
γ Sge	3.7	K5	19 57 17.3	+19 24 05	δ Equ	4.6	F5	21 12 52.3	+ 9 52 20
θ ¹ Sgr	4.4	B3	19 57 35.5	-35 22 02	τ Cyg	3.8	F0	21 13 28.3	+37 54 14
15 Vul	4.7	A5	19 59 44.4	+27 39 41	α Equ	4.1	F8, A3	21 14 10.4	+ 5 06 38
62 Sgr	4.6	M3	20 00 37.8	-27 48 11	σ Cyg	4.3	A0p	21 16 07.0	+39 15 20
ρ Dra	4.7	K0	20 02 40.5	+67 46 46	ν Cyg	4.4	B3p	21 16 33.5	+34 45 27
δ Pav	3.6	G5	20 05 30.2	-66 16 07	θ Ind	4.6	A5	21 17 31.4	-53 35 21
θ Aql	3.4	A0	20 09 36.1	- 0 55 14	α Cep	2.6	A5	21 17 47.5	+62 26 43
κ Cep	4.4	B9	20 10 01.9	+77 36 46	ι Cap	4.3	K0	21 20 24.6	-16 58 34
α ² Cyg	3.9	K0, B8	20 12 35.5	+46 38 26	1 Peg	4.3	K0	21 20 33.5	+19 39 45
33 Cyg	4.3	A3	20 12 37.8	+56 27 58	γ Pav	4.3	F8	21 23 44.2	-65 31 01
23 Vul	4.7	K5	20 14 24.0	+27 42 43	ζ Cap	3.9	G5p	21 24 47.1	-22 33 19
32 Cyg	4.2	K0, A3	20 14 27.0	+47 36 44	36 Cap	4.6	G5	21 26 50.6	-21 57 07
α ¹ Cap	4.5	G0p	20 15 49.1	-12 36 41	β Cep	3.3	B1	21 28 14.4	+70 24 56
α ² Cap	3.8	G5	20 16 13.4	-12 38 54	β Aqr	3.1	G0	21 29 49.3	- 5 43 02
β Cap	3.2	G0, A0	20 19 09.5	-14 53 13	ρ Cyg	4.2	K0	21 32 44.2	+45 26 43
γ Cyg	2.3	F8p	20 21 02.5	+40 09 01	ε Cap	4.7	B5p	21 35 14.1	-19 36 53

FOR JANUARY 1^d.041

Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
ν Oct	3.7	K0	21 37 52.6	-77 32 17	β Oct	4.3	F0	22 42 47.8	-81 33 20
γ Cap	3.8	F0 _p	21 38 15.8	-16 48 44	λ Peg	4.1	K0	22 44 56.3	+23 23 29
μ Cep	4-5	M2	21 42 29.7	+58 37 41	ξ Peg	4.3	F5	22 45 02.5	+12 00 11
ϵ Peg	2.5	K0	21 42 33.8	+ 9 43 22	ϵ Gru	3.7	A2	22 46 34.2	-51 29 27
μ Cyg	4.7	F5	21 42 39.9	+28 35 35	τ Aqr	4.2	K5	22 47 50.7	-13 46 02
9 Peg	4.5	G5	21 42 56.8	+17 11 52	μ Peg	3.7	K0	22 48 24.4	+24 25 37
ι Ps A	4.3	A0	21 42 59.1	-33 10 39	ι Cep	3.7	K0	22 48 30.0	+66 01 36
κ Peg	4.3	F5	21 43 08.9	+25 29 33	γ Ps A	4.5	A0	22 50 41.7	-33 03 04
ν Cep	4.5	A2 _p	21 44 29.7	+60 58 05	λ Aqr	3.8	M0	22 50 53.5	- 7 45 20
δ Cap	3.0	A5	21 45 13.2	-16 16 40	δ Aqr	3.5	A2	22 52 54.0	-15 59 48
π^2 Cyg	4.3	B3	21 45 34.3	+49 09 23	δ Ps A	4.3	K0	22 54 07.4	-32 42 59
γ Gru	3.2	B8	21 51 56.1	-37 31 15	α Ps A	1.3	A3	22 55 49.8	-29 47 51
δ Ind	4.6	F0	21 55 41.0	-55 09 02	ζ Gru	4.2	G5	22 58 56.4	-52 55 54
ϵ Ind	4.7	K5	22 00 50.9	-56 55 22	\circ And	3.6	B5, A2 _p	23 00 23.9	+42 08 54
\circ Aqr	4.7	B5 _p	22 01 36.4	- 2 18 56	β Peg	2.6	M0	23 02 10.2	+27 54 12
ξ Cep	4.6	A3	22 02 50.0	+64 28 00	β Psc	4.6	B5 _p	23 02 11.7	+ 3 38 31
α Aqr	3.2	G0	22 04 05.3	- 0 28 51	α Peg	2.6	A0	23 03 06.9	+15 01 38
λ Gru	4.6	K2	22 04 07.9	-39 42 12	θ Gru	4.3	F5	23 05 01.5	-43 41 57
ι Aqr	4.3	B8	22 04 39.3	-14 01 50	55 Peg	4.7	M0	23 05 20.4	+ 9 13 51
ι Peg	4.0	F5	22 05 28.3	+25 11 00	π Cep	4.6	G5	23 06 50.5	+75 12 32
α Gru	2.2	B5	22 06 09.6	-47 07 18	88 Aqr	3.8	K0	23 07 41.3	-21 21 07
μ Ps A	4.6	A2	22 06 27.7	-33 09 02	ι Gru	4.1	K0	23 08 29.8	-45 25 33
π Peg	4.4	F5	22 08 31.1	+33 00 56	7 And	4.6	F0	23 11 01.9	+49 13 33
θ Peg	3.7	A2	22 08 32.0	+ 6 02 05	ϕ Aqr	4.4	M0	23 12 36.8	- 6 13 38
ζ Cep	3.6	K0	22 09 42.4	+58 02 17	ψ^1 Aqr	4.5	K0	23 14 09.8	- 9 16 04
1 H. Lac	4.6	K2	22 12 27.5	+39 33 02	γ Psc	3.8	K0	23 15 27.2	+ 3 06 06
ϵ Cep	4.2	F0	22 13 49.0	+56 52 43	γ Tuc	4.1	F2	23 15 30.8	-58 25 01
1 Lac	4.2	K0	22 14 31.7	+37 35 02	93 Aqr	4.6	B5	23 16 11.3	- 9 21 47
θ Aqr	4.3	K0	22 15 05.5	- 7 56 54	γ Scl	4.5	K0	23 17 02.7	-32 42 43
α Tuc	2.9	K2	22 16 15.3	-60 25 30	τ Peg	4.6	A5	23 19 00.0	+23 33 34
2 Lac	4.7	B5	22 19 39.5	+46 22 12	98 Aqr	4.2	K0	23 21 14.3	-20 16 51
γ Aqr	4.0	A0	22 19 57.1	- 1 33 15	ν Peg	4.6	G0	23 23 43.7	+23 13 20
β Lac	4.6	K0	22 22 15.5	+52 03 48	99 Aqr	4.5	K5	23 24 18.8	-20 49 23
4 Lac	4.6	B8 _p	22 23 10.4	+49 18 31	θ Psc	4.4	G5	23 26 17.5	+ 6 11 51
π Aqr	4.6	B1 _p	22 23 35.4	+ 1 12 34	70 Peg	4.7	K0	23 27 29.0	+12 34 42
ζ Aqr	4.4	F2	22 27 08.0	- 0 11 23	β Scl	4.5	B9	23 31 12.3	-38 00 04
δ^1 Gru	4.0	G5	22 27 18.2	-43 39 54	λ And	4.0	K0	23 35 56.5	+46 16 45
δ^2 Gru	4.3	M4	22 27 47.5	-43 55 08	ι And	4.3	B8	23 36 30.7	+43 05 07
δ Cep	3-4	F5-G0	22 27 56.4	+58 14 45	γ Cep	3.4	K0	23 37 58.6	+77 26 53
5 Lac	4.6	K0, A0	22 28 09.1	+47 32 15	ι Psc	4.3	F8	23 38 15.1	+ 5 26 50
6 Lac	4.5	B3	22 29 03.5	+42 57 14	κ And	4.3	A0	23 38 46.5	+44 09 04
β Ps A	4.4	A0	22 29 38.0	-32 30 57	λ Psc	4.6	A5	23 40 21.7	+ 1 35 54
α Lac	3.8	A0	22 29 55.6	+50 06 45	ω^2 Aqr	4.6	A0	23 41 00.7	-14 43 39
η Aqr	4.1	B8	22 33 39.6	- 0 17 17	δ Scl	4.6	A0	23 47 12.5	-28 18 46
ϵ Ps A	4.2	B8	22 38 50.0	-27 12 59	ρ Cas	4-5	F8 _p	23 52 43.5	+57 18 57
11 Lac	4.6	K0	22 39 03.7	+44 06 13	ψ Peg	4.7	M0	23 56 04.4	+24 57 29
ζ Peg	3.6	B8	22 39 48.9	+10 39 31	ω Psc	4.0	F5	23 57 36.9	+ 6 40 50
β Gru	2.2	M3	22 40 42.2	-47 03 28	ϵ Tuc	4.7	B9	23 58 12.8	-65 45 39
η Peg	3.1	G0	22 41 27.1	+30 02 53	θ Oct	4.7	K0	23 59 55.4	-77 14 52

There are four eclipses, two of the Sun and two of the Moon.

I	April 24	Total eclipse of the Moon
II	May 9	Partial eclipse of the Sun
III	October 18	Total eclipse of the Moon
IV	November 2	Total eclipse of the Sun

A correction of $-0''.6$ has been applied to the tabular latitude of the Moon. This correction is given below in the form of corrections to the right ascension and declination of the Moon.

	d	$\Delta\alpha$ s	$\Delta\delta$ "
April	24	- 0.014	- 0.56
May	9	+ 0.012	- 0.58
October	18	+ 0.015	- 0.56
November	2	- 0.013	- 0.57

The arguments are given in Ephemeris Time. The hour angle μ and the longitudes are referred to the ephemeris meridian. East longitudes are negative. Once the value of ΔT is known, the data on these pages may be expressed in terms of Universal Time in the following manner:

Convert all arguments into Universal Time by the relation $U.T. = E.T. - \Delta T$.

Apply the correction $-1.0027 \Delta T$ to μ and to the longitudes, in order to refer them to the meridian of Greenwich, remembering that a second of time is equivalent to 15 seconds of arc.

Leave all other quantities unchanged.

I.—*Total Eclipse of the Moon*, April 24; the beginning of the penumbral phase visible in North America except the northeast part, the western part of South America, the Pacific Ocean, the east coast of Asia, Australia, New Zealand, and Antarctica; the end visible in the Pacific Ocean except the southeastern part, the eastern part of Asia, the eastern part of the Indian Ocean, Indonesia, Australia, New Zealand, and Antarctica.

ELEMENTS OF THE ECLIPSE

E.T. of geocentric opposition in right ascension, April 24^d 11^h 52^m 24^s.56

	h	m	s		s
R.A. of Sun	2	05	30.272	Hourly motion	9.389
R.A. of Moon	14	05	30.272	Hourly motion	140.699
	°	'	"		'
Declination of Sun	+12	43	26.58	Hourly motion	+ 0 49.61
Declination of Moon	-12	23	18.24	Hourly motion	-16 07.43
Equatorial hor. par. of Sun			8.75	True semidiameter of Sun	15 54.1
Equatorial hor. par. of Moon	61	12.06		True semidiameter of Moon	16 40.5

CIRCUMSTANCES OF THE ECLIPSE

	d	h	m	
Moon enters penumbra	April	24	09 28.9	} E.T.
Moon enters umbra		24	10 25.3	
Total eclipse begins		24	11 27.6	
Middle of the eclipse		24	12 07.1	
Total eclipse ends		24	12 46.4	
Moon leaves umbra		24	13 48.8	
Moon leaves penumbra		24	14 45.2	

Contacts of Umbra with Limb of Moon	Position Angles from the North Point °	The Moon being in the Zenith in	
		Ephemeris Longitude °	Latitude °
First	132 to E.	+157 34	-12 00
Last	81 to W.	-153 25	-12 54

Magnitude of the eclipse 1.342

II.—*Partial Eclipse of the Sun, May 9.*

ELEMENTS OF THE ECLIPSE

E.T. of geocentric conjunction in right ascension, May 9^d 15^h 36^m 04^s.47

R.A. of Sun and Moon	^h 3	^m 03	^s 25.891	Hourly motions	^s 9.733 and 118.683
	[°] °	['] '	["] "		['] '
Declination of Sun	+17	17	13.76	Hourly motion	+ 0 40.21
Declination of Moon	+18	24	02.96	Hourly motion	+10 57.22
Equatorial hor. par. of Sun			8.72	True semidiameter of Sun	15 50.5
Equatorial hor. par. of Moon	54	31.10		True semidiameter of Moon	14 51.3

CIRCUMSTANCES OF THE ECLIPSE

	E.T.	Ephemeris Longitude	Latitude
	^d d	^h h	^m m
Eclipse begins	May 9 12 37.3	+108 12	+24 05
Greatest eclipse	9 14 42.8	+168 30	+62 37
Eclipse ends	9 16 47.8	- 54 34	+62 52

Magnitude of greatest eclipse 0.721

III.—*Total Eclipse of the Moon, October 18*; the beginning of the penumbral phase visible in North America, the northwestern part of the Atlantic Ocean, most of South America, the Pacific Ocean, the east coast of Australia, New Zealand, the northeastern part of Asia, and the arctic regions; the end visible in North America except the east coast, the Pacific Ocean except the southeastern part, Australia, New Zealand, Asia except the southwestern part, the eastern part of the Indian Ocean, and the arctic regions.

ELEMENTS OF THE ECLIPSE

E.T. of geocentric opposition in right ascension, October 18^d 09^h 53^m 14^s.81

R.A. of Sun	^h 13	^m 30	^s 07.244	Hourly motion	^s 9.357
R.A. of Moon	1	30	07.244	Hourly motion	107.144
	[°] °	['] '	["] "		['] '
Declination of Sun	-9	26	05.77	Hourly motion	- 0 54.71
Declination of Moon	+9	03	53.16	Hourly motion	+13 23.29
Equatorial hor. par. of Sun			8.83	True semidiameter of Sun	16 03.3
Equatorial hor. par. of Moon	54	00.16		True semidiameter of Moon	14 42.8

CIRCUMSTANCES OF THE ECLIPSE

	^d d	^h h	^m m
Moon enters penumbra	October 18	07	10.4
Moon enters umbra		18	08 26.0
Total eclipse begins		18	09 45.4
Middle of the eclipse		18	10 15.8
Total eclipse ends		18	10 46.1
Moon leaves umbra		18	12 05.5
Moon leaves penumbra		18	13 21.1

Contacts of Umbra with Limb of Moon	Position Angles from the North Point	The Moon being in the Zenith in Ephemeris Longitude	Latitude
	[°] °	['] '	['] '
First	41 to E.	+130 46	+8 44
Last	96 to W.	-175 51	+9 33

Magnitude of the eclipse 1.147

IV.—*Total Eclipse of the Sun*, November 2.

ELEMENTS OF THE ECLIPSE

E.T. of geocentric conjunction in right ascension, November 2^d 06^h 25^m 03^s.19

R.A. of Sun and Moon	h m s			Hourly motions	s s	
	°	'	"		'	"
Declination of Sun	-14	32	45.24	Hourly motion	- 0	47.89
Declination of Moon	-15	39	57.43	Hourly motion	-15	24.53
Equatorial hor. par. of Sun			8.87	True semidiameter of Sun	16	07.1
Equatorial hor. par. of Moon	61	25.36		True semidiameter of Moon	16	44.1

CIRCUMSTANCES OF THE ECLIPSE

	November	E.T.			Ephemeris Longitude ° '	Latitude ° '
		d	h	m		
Eclipse begins		2	03	39.0	- 26 53	-16 02
Total eclipse begins		2	05	26.8	+ 18 38	-56 16
Greatest eclipse		2	05	38.9	+ 28 12	-62 09
Total eclipse ends		2	05	50.5	+ 40 12	-67 22
Eclipse ends		2	07	38.5	-179 37	-61 18

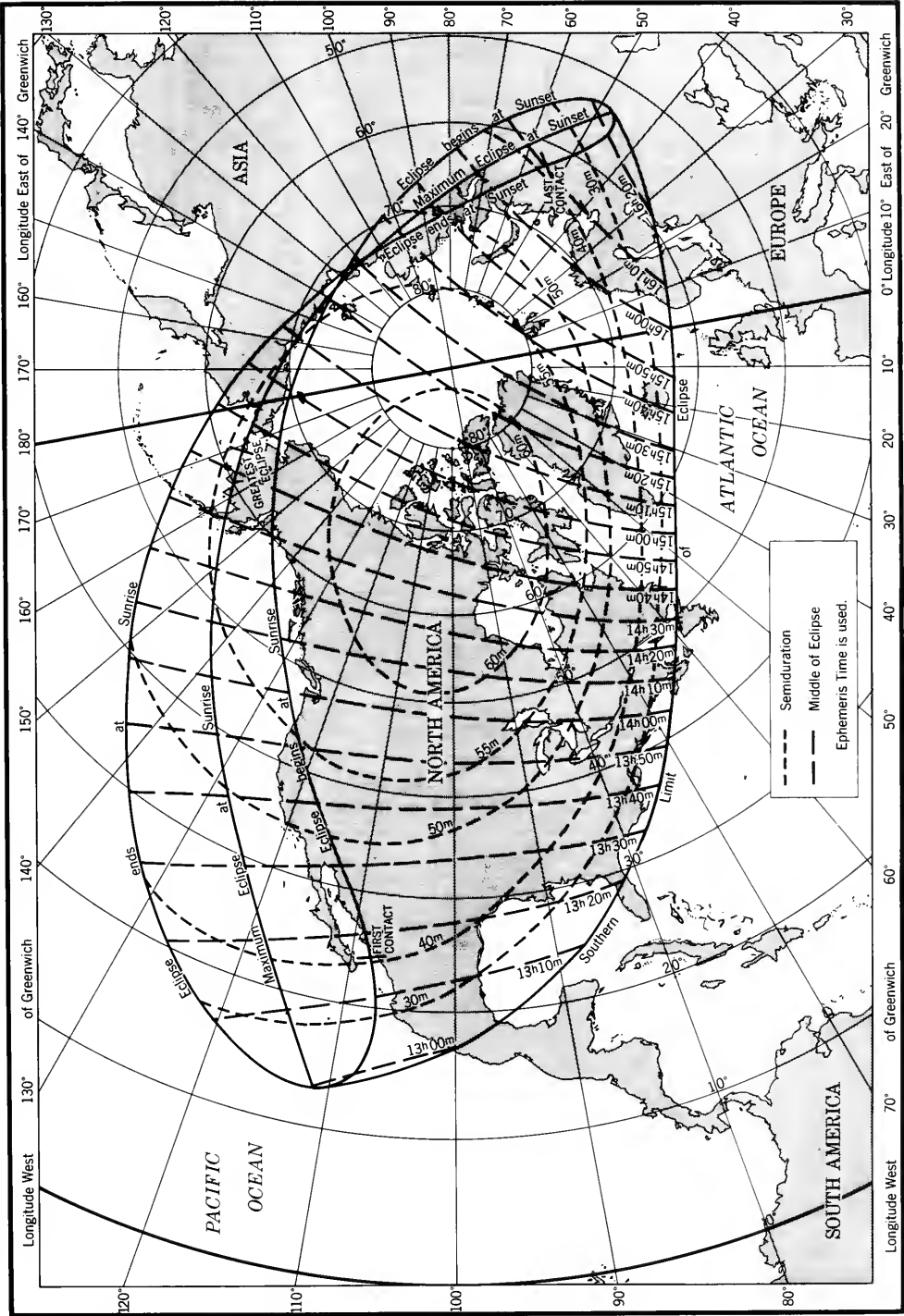
The closest approach of the Earth to the axis of shadow is approximately 14 miles, and occurs at the time and place of greatest eclipse. Total phases of this eclipse will occur at all places within the small area noted "Path of Total Eclipse." limited on one side by the curve "Maximum Eclipse at Sunrise."

BESSELIAN ELEMENTS OF THE PARTIAL ECLIPSE OF THE SUN MAY 9

E.T.	Intersection of Axis of Shadow with Fundamental Plane		Direction of Axis of Shadow			Radius of Shadow on Fundamental Plane
	<i>x</i>	<i>y</i>	<i>sin d</i>	<i>cos d</i>	<i>μ</i>	Penumbra
<div>h m</div>					<div>° ' "</div>	
12 30	-1.473480	+0.641981	+0.296557	0.955015	8 23 50.5	0.564678
40	1.394334	0.673585	.296587	.955006	10 53 51.5	.564674
50	1.315183	0.705183	.296617	.954997	13 23 52.6	.564669
13 00	-1.236025	+0.736774	+0.296646	0.954987	15 53 53.6	0.564664
10	1.156862	0.768358	.296676	.954978	18 23 54.6	.564658
20	1.077694	0.799934	.296706	.954969	20 53 55.7	.564651
30	0.998521	0.831504	.296736	.954960	23 23 56.7	.564644
40	0.919342	0.863067	.296766	.954950	25 53 57.8	.564637
50	0.840159	0.894623	.296795	.954941	28 23 58.8	.564628
14 00	-0.760972	+0.926171	+0.296825	0.954932	30 53 59.8	0.564620
10	0.681781	0.957713	.296855	.954923	33 24 00.9	.564610
20	0.602586	0.989247	.296885	.954913	35 54 01.9	.564601
30	0.523388	1.020774	.296915	.954904	38 24 02.9	.564590
40	0.444185	1.052293	.296944	.954895	40 54 04.0	.564579
50	0.364980	1.083805	.296974	.954886	43 24 05.0	.564568
15 00	-0.285771	+1.115309	+0.297004	0.954876	45 54 06.0	0.564556
10	0.206558	1.146804	.297034	.954867	48 24 07.1	.564543
20	0.127342	1.178292	.297063	.954858	50 54 08.1	.564530
30	-0.048123	1.209772	.297093	.954848	53 24 09.1	.564516
40	+0.031100	1.241243	.297123	.954839	55 54 10.2	.564502
50	0.110325	1.272707	.297153	.954830	58 24 11.2	.564487
16 00	+0.189552	+1.304163	+0.297182	0.954821	60 54 12.2	0.564472
10	0.268783	1.335611	.297212	.954811	63 24 13.3	.564456
20	0.348015	1.367052	.297242	.954802	65 54 14.3	.564439
30	0.427250	1.398484	.297272	.954793	68 24 15.3	.564422
40	0.506487	1.429909	.297301	.954784	70 54 16.4	.564405
50	+0.585725	+1.461325	+0.297331	0.954774	73 24 17.4	0.564387

$\tan f_1$ 0.004632
 μ' 0.261830 radians per hour
 d' +0.000187 radians per hour

PARTIAL SOLAR ECLIPSE OF 1967 MAY 9



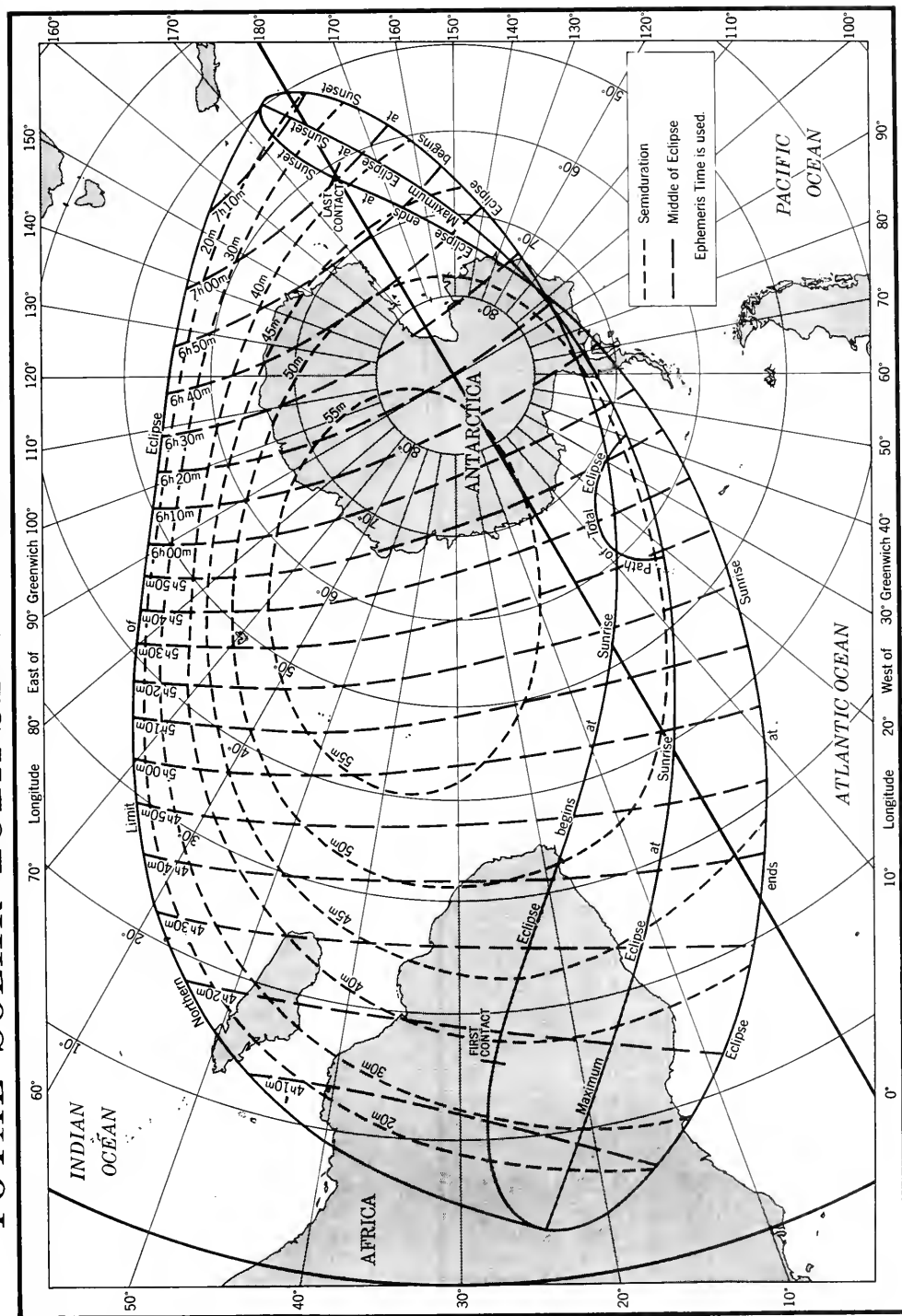
BESSELIAN ELEMENTS OF THE TOTAL ECLIPSE OF THE SUN NOVEMBER 2

E.T.		Intersection of Axis of Shadow with Fundamental Plane		Direction of Axis of Shadow			Radius of Shadow on Fundamental Plane	
		<i>x</i>	<i>y</i>	<i>sin d</i>	<i>cos d</i>	<i>μ</i>	Penumbra	Umbra
<i>h</i>	<i>m</i>					<i>°</i> <i>'</i> <i>''</i>		
3	30	-1.552703	-0.399797	-0.250483	0.968121	236 35 27.8	0.536065	-0.010216
	40	1.464047	0.439671	.250518	.968112	239 05 28.8	.536076	.010205
	50	1.375384	0.479538	.250554	.968103	241 35 29.7	.536087	.010195
4	00	-1.286715	-0.519398	-0.250590	0.968093	244 05 30.7	0.536096	-0.010185
	10	1.198040	0.559251	.250626	.968084	246 35 31.6	.536105	.010176
	20	1.109359	0.599097	.250662	.968075	249 05 32.6	.536113	.010168
	30	1.020673	0.638936	.250698	.968065	251 35 33.5	.536121	.010161
	40	0.931981	0.678768	.250734	.968056	254 05 34.5	.536128	.010154
	50	0.843285	0.718592	.250769	.968047	256 35 35.4	.536134	.010148
5	00	-0.754584	-0.758408	-0.250805	0.968038	259 05 36.4	0.536139	-0.010143
	10	0.665878	0.798217	.250841	.968028	261 35 37.3	.536144	.010138
	20	0.577169	0.838018	.250877	.968019	264 05 38.2	.536147	.010134
	30	0.488455	0.877811	.250913	.968010	266 35 39.2	.536151	.010131
	40	0.399737	0.917596	.250949	.968000	269 05 40.1	.536153	.010129
	50	0.311017	0.957373	.250984	.967991	271 35 41.1	.536155	.010127
6	00	-0.222293	-0.997142	-0.251020	0.967982	274 05 42.0	0.536156	-0.010126
	10	0.133566	1.036903	.251056	.967973	276 35 43.0	.536156	.010126
	20	-0.044837	1.076655	.251092	.967963	279 05 43.9	.536155	.010126
	30	+0.043894	1.116399	.251128	.967954	281 35 44.8	.536154	.010128
	40	0.132628	1.156134	.251163	.967945	284 05 45.8	.536152	.010130
	50	0.221364	1.195861	.251199	.967935	286 35 46.7	.536150	.010132
7	00	+0.310101	-1.235578	-0.251235	0.967926	289 05 47.7	0.536146	-0.010136
	10	0.398840	1.275287	.251271	.967917	291 35 48.6	.536142	.010140
	20	0.487581	1.314986	.251307	.967908	294 05 49.5	.536137	.010144
	30	0.576322	1.354676	.251342	.967898	296 35 50.5	.536132	.010150
	40	+0.665065	-1.394357	-0.251378	0.967889	299 05 51.4	0.536125	-0.010156
		$\tan f_1$	0.004712	μ'	0.261827 radians per hour			
		$\tan f_2$	0.004688	d'	-0.000222 radians per hour			

PATH OF TOTAL PHASE DURING THE ECLIPSE OF THE SUN NOVEMBER 2

E.T.	Northern Limit		E.T.	Northern Limit	
	Latitude	Ephemeris Longitude		Latitude	Ephemeris Longitude
Limit	<div>° '</div> <div>-56 16</div>	<div>° '</div> <div>+18 38</div>	<div>h m</div> <div>5 39</div>	<div>° '</div> <div>-65 17.0</div>	<div>° '</div> <div>+14 20.4</div>
<div>h m</div> <div>5 27</div>	<div>° '</div> <div>-57 04.9</div>	<div>° '</div> <div>+16 11.7</div>	40	<div>° '</div> <div>65 47.4</div>	<div>° '</div> <div>15 08.7</div>
28	<div>° '</div> <div>58 14.7</div>	<div>° '</div> <div>14 05.1</div>	41	<div>° '</div> <div>-66 16.7</div>	<div>° '</div> <div>+16 05.2</div>
29	<div>° '</div> <div>59 06.5</div>	<div>° '</div> <div>13 05.7</div>	42	<div>° '</div> <div>66 44.6</div>	<div>° '</div> <div>17 10.1</div>
30	<div>° '</div> <div>59 52.2</div>	<div>° '</div> <div>12 30.3</div>	43	<div>° '</div> <div>67 11.1</div>	<div>° '</div> <div>18 24.4</div>
			44	<div>° '</div> <div>67 35.8</div>	<div>° '</div> <div>19 49.3</div>
31	<div>° '</div> <div>-60 34.5</div>	<div>° '</div> <div>+12 09.4</div>	45	<div>° '</div> <div>67 58.3</div>	<div>° '</div> <div>21 26.1</div>
32	<div>° '</div> <div>61 14.5</div>	<div>° '</div> <div>11 59.3</div>			
33	<div>° '</div> <div>61 52.7</div>	<div>° '</div> <div>11 58.1</div>	46	<div>° '</div> <div>-68 18.1</div>	<div>° '</div> <div>+23 16.7</div>
34	<div>° '</div> <div>62 29.5</div>	<div>° '</div> <div>12 04.5</div>	47	<div>° '</div> <div>68 34.2</div>	<div>° '</div> <div>25 24.3</div>
35	<div>° '</div> <div>63 05.1</div>	<div>° '</div> <div>12 18.1</div>	48	<div>° '</div> <div>68 45.1</div>	<div>° '</div> <div>27 53.0</div>
			49	<div>° '</div> <div>68 47.6</div>	<div>° '</div> <div>30 52.9</div>
36	<div>° '</div> <div>-63 39.6</div>	<div>° '</div> <div>+12 38.4</div>	50	<div>° '</div> <div>68 31.8</div>	<div>° '</div> <div>34 52.8</div>
37	<div>° '</div> <div>64 13.0</div>	<div>° '</div> <div>13 05.6</div>			
38	<div>° '</div> <div>-64 45.5</div>	<div>° '</div> <div>+13 39.4</div>	Limit	<div>° '</div> <div>-67 22</div>	<div>° '</div> <div>+40 12</div>

TOTAL SOLAR ECLIPSE OF 1967 NOVEMBER 2



EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h UNIVERSAL TIME

Date	<i>P</i>	<i>B</i> ₀	<i>L</i> ₀	Date	<i>P</i>	<i>B</i> ₀	<i>L</i> ₀
	°	°	°		°	°	°
Jan. 0	+ 2.83	-2.89	346.22	Feb. 15	-17.24	-6.82	100.51
1	2.35	3.01	333.05	16	17.57	6.87	87.35
2	1.86	3.12	319.87	17	17.91	6.91	74.18
3	1.38	3.24	306.70	18	18.23	6.94	61.01
4	0.89	3.36	293.53	19	18.55	6.98	47.84
5	+ 0.40	-3.47	280.36	20	-18.87	-7.01	34.67
6	- 0.08	3.58	267.20	21	19.17	7.04	21.50
7	0.57	3.69	254.03	22	19.48	7.07	8.33
8	1.05	3.80	240.86	23	19.77	7.10	355.16
9	1.53	3.91	227.69	24	20.06	7.13	341.99
10	- 2.02	-4.02	214.52	25	-20.35	-7.15	328.82
11	2.50	4.13	201.35	26	20.63	7.17	315.65
12	2.97	4.23	188.19	27	20.90	7.19	302.47
13	3.45	4.34	175.02	28	21.16	7.20	289.30
14	3.93	4.44	161.85	Mar. 1	21.42	7.22	276.13
15	- 4.40	-4.54	148.68	2	-21.68	-7.23	262.96
16	4.87	4.64	135.52	3	21.93	7.24	249.78
17	5.34	4.74	122.35	4	22.17	7.24	236.61
18	5.80	4.83	109.18	5	22.40	7.25	223.44
19	6.26	4.93	96.01	6	22.63	7.25	210.26
20	- 6.72	-5.02	82.85	7	-22.85	-7.25	197.09
21	7.18	5.12	69.68	8	23.07	7.25	183.91
22	7.63	5.21	56.51	9	23.27	7.24	170.73
23	8.08	5.29	43.35	10	23.48	7.24	157.56
24	8.53	5.38	30.18	11	23.67	7.23	144.38
25	- 8.97	-5.47	17.01	12	-23.86	-7.22	131.20
26	9.41	5.55	3.85	13	24.04	7.20	118.03
27	9.84	5.63	350.68	14	24.22	7.19	104.85
28	10.27	5.71	337.51	15	24.39	7.17	91.67
29	10.70	5.79	324.35	16	24.55	7.15	78.49
30	-11.12	-5.87	311.18	17	-24.70	-7.13	65.31
31	11.54	5.94	298.01	18	24.85	7.11	52.12
Feb. 1	11.96	6.01	284.85	19	24.99	7.08	38.94
2	12.36	6.09	271.68	20	25.13	7.05	25.76
3	12.77	6.15	258.51	21	25.26	7.02	12.58
4	-13.17	-6.22	245.35	22	-25.38	-6.99	359.39
5	13.56	6.29	232.18	23	25.49	6.95	346.21
6	13.96	6.35	219.01	24	25.60	6.92	333.02
7	14.34	6.41	205.85	25	25.70	6.88	319.83
8	14.72	6.47	192.68	26	25.79	6.84	306.64
9	-15.10	-6.53	179.52	27	-25.88	-6.80	293.46
10	15.47	6.58	166.35	28	25.95	6.75	280.27
11	15.83	6.63	153.18	29	26.03	6.70	267.08
12	16.19	6.68	140.02	30	26.09	6.66	253.89
13	16.55	6.73	126.85	31	26.15	6.61	240.69
14	-16.89	-6.78	113.68	Apr. 1	-26.20	-6.55	227.50
15	-17.24	-6.82	100.51	2	-26.24	-6.50	214.31

EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h UNIVERSAL TIME

Date	<i>P</i>	<i>B</i> ₀	<i>L</i> ₀	Date	<i>P</i>	<i>B</i> ₀	<i>L</i> ₀
	°	°	°		°	°	°
Apr. 1	-26.20	-6.55	227.50	May 17	-20.65	-2.46	339.83
2	26.24	6.50	214.31	18	20.36	2.35	326.60
3	26.28	6.44	201.12	19	20.07	2.23	313.37
4	26.31	6.38	187.92	20	19.77	2.11	300.15
5	26.33	6.32	174.73	21	19.47	2.00	286.92
6	-26.34	-6.26	161.53	22	-19.16	-1.88	273.69
7	26.35	6.20	148.34	23	18.84	1.76	260.46
8	26.35	6.13	135.14	24	18.51	1.65	247.23
9	26.34	6.06	121.94	25	18.19	1.53	234.00
10	26.33	6.00	108.74	26	17.85	1.41	220.77
11	-26.30	-5.93	95.54	27	-17.51	-1.29	207.53
12	26.27	5.85	82.34	28	17.16	1.17	194.30
13	26.24	5.78	69.14	29	16.81	1.05	181.07
14	26.19	5.70	55.94	30	16.45	0.93	167.84
15	26.14	5.63	42.73	31	16.09	0.81	154.60
16	-26.08	-5.55	29.53	June 1	-15.72	-0.69	141.37
17	26.02	5.47	16.33	2	15.35	0.57	128.14
18	25.94	5.38	3.12	3	14.97	0.45	114.90
19	25.86	5.30	349.91	4	14.59	0.33	101.67
20	25.77	5.21	336.71	5	14.20	0.21	88.43
21	-25.68	-5.13	323.50	6	-13.81	-0.09	75.20
22	25.57	5.04	310.29	7	13.42	+0.03	61.97
23	25.46	4.95	297.08	8	13.02	0.15	48.73
24	25.35	4.86	283.87	9	12.61	0.28	35.50
25	25.22	4.77	270.66	10	12.20	0.40	22.26
26	-25.09	-4.67	257.44	11	-11.79	+0.52	9.02
27	24.95	4.58	244.23	12	11.38	0.64	355.79
28	24.80	4.48	231.02	13	10.96	0.76	342.55
29	24.65	4.39	217.80	14	10.54	0.88	329.32
30	24.49	4.29	204.59	15	10.11	1.00	316.08
May 1	-24.32	-4.19	191.37	16	- 9.68	+1.12	302.84
2	24.14	4.09	178.16	17	9.25	1.23	289.61
3	23.96	3.99	164.94	18	8.82	1.35	276.37
4	23.77	3.88	151.72	19	8.38	1.47	263.13
5	23.57	3.78	138.50	20	7.94	1.59	249.89
6	-23.36	-3.67	125.28	21	- 7.50	+1.71	236.66
7	23.15	3.57	112.06	22	7.06	1.82	223.42
8	22.93	3.46	98.84	23	6.61	1.94	210.18
9	22.71	3.35	85.62	24	6.17	2.06	196.95
10	22.47	3.24	72.40	25	5.72	2.17	183.71
11	-22.23	-3.13	59.18	26	- 5.27	+2.28	170.47
12	21.99	3.02	45.95	27	4.82	2.40	157.23
13	21.73	2.91	32.73	28	4.37	2.51	144.00
14	21.47	2.80	19.51	29	3.92	2.62	130.76
15	21.21	2.69	6.28	30	3.46	2.74	117.52
16	-20.93	-2.57	353.06	July 1	- 3.01	+2.85	104.29
17	-20.65	-2.46	339.83	2	- 2.55	+2.96	91.05

EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h UNIVERSAL TIME

Date	<i>P</i>	<i>B</i> ₀	<i>L</i> ₀	Date	<i>P</i>	<i>B</i> ₀	<i>L</i> ₀
	°	°	°		°	°	°
July 1	- 3.01	+2.85	104.29	Aug. 16	+16.15	+6.68	215.77
2	2.55	2.96	91.05	17	16.48	6.72	202.55
3	2.10	3.07	77.82	18	16.82	6.77	189.34
4	1.64	3.18	64.58	19	17.14	6.81	176.12
5	1.19	3.28	51.34	20	17.47	6.85	162.90
6	- 0.73	+3.39	38.11	21	+17.79	+6.89	149.69
7	- 0.28	3.50	24.87	22	18.10	6.93	136.47
8	+ 0.18	3.60	11.64	23	18.41	6.96	123.26
9	0.63	3.71	358.41	24	18.71	7.00	110.04
10	1.08	3.81	345.17	25	19.01	7.03	96.83
11	+ 1.53	+3.91	331.94	26	+19.30	+7.06	83.62
12	1.98	4.01	318.70	27	19.59	7.08	70.40
13	2.43	4.11	305.47	28	19.87	7.11	57.19
14	2.88	4.21	292.24	29	20.15	7.13	43.98
15	3.33	4.31	279.00	30	20.42	7.15	30.77
16	+ 3.77	+4.40	265.77	31	+20.68	+7.17	17.56
17	4.22	4.50	252.54	Sept. 1	20.95	7.19	4.35
18	4.66	4.59	239.31	2	21.20	7.20	351.14
19	5.10	4.69	226.08	3	21.45	7.22	337.93
20	5.53	4.78	212.84	4	21.70	7.23	324.72
21	+ 5.97	+4.87	199.61	5	+21.93	+7.24	311.52
22	6.40	4.96	186.38	6	22.17	7.24	298.31
23	6.83	5.04	173.15	7	22.39	7.25	285.10
24	7.26	5.13	159.92	8	22.62	7.25	271.90
25	7.68	5.22	146.69	9	22.83	7.25	258.69
26	+ 8.10	+5.30	133.46	10	+23.04	+7.25	245.49
27	8.52	5.38	120.23	11	23.24	7.24	232.28
28	8.94	5.46	107.01	12	23.44	7.24	219.08
29	9.35	5.54	93.78	13	23.63	7.23	205.88
30	9.76	5.62	80.55	14	23.82	7.22	192.67
31	+10.17	+5.69	67.32	15	+24.00	+7.21	179.47
Aug. 1	10.57	5.77	54.10	16	24.17	7.19	166.27
2	10.97	5.84	40.87	17	24.34	7.18	153.07
3	11.37	5.91	27.65	18	24.50	7.16	139.86
4	11.76	5.98	14.42	19	24.65	7.14	126.66
5	+12.15	+6.05	1.20	20	+24.80	+7.12	113.46
6	12.53	6.11	347.98	21	24.94	7.09	100.26
7	12.91	6.18	334.75	22	25.08	7.06	87.06
8	13.29	6.24	321.53	23	25.20	7.03	73.86
9	13.66	6.30	308.31	24	25.33	7.00	60.66
10	+14.03	+6.36	295.09	25	+25.44	+6.97	47.47
11	14.39	6.42	281.87	26	25.55	6.93	34.27
12	14.75	6.47	268.65	27	25.65	6.90	21.07
13	15.11	6.53	255.43	28	25.75	6.86	7.87
14	15.46	6.58	242.21	29	25.83	6.82	354.68
15	+15.81	+6.63	228.99	30	+25.92	+6.77	341.48
16	+16.15	+6.68	215.77	Oct. 1	+25.99	+6.73	328.29

EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h UNIVERSAL TIME

Date	<i>P</i>	<i>B</i> ₀	<i>L</i> ₀	Date	<i>P</i>	<i>B</i> ₀	<i>L</i> ₀
	°	°	°		°	°	°
Oct. 1	+25.99	+6.73	328.29	Nov. 16	+21.36	+2.75	81.61
2	26.06	6.68	315.09	17	21.08	2.64	68.43
3	26.12	6.63	301.90	18	20.79	2.52	55.25
4	26.17	6.58	288.70	19	20.49	2.40	42.06
5	26.22	6.53	275.51	20	20.19	2.28	28.88
6	+26.26	+6.47	262.31	21	+19.88	+2.15	15.70
7	26.29	6.41	249.12	22	19.56	2.03	2.52
8	26.32	6.35	235.93	23	19.23	1.91	349.34
9	26.34	6.29	222.73	24	18.90	1.79	336.16
10	26.35	6.23	209.54	25	18.56	1.66	322.98
11	+26.35	+6.17	196.35	26	+18.21	+1.54	309.80
12	26.35	6.10	183.16	27	17.86	1.41	296.62
13	26.33	6.03	169.97	28	17.50	1.29	283.44
14	26.31	5.96	156.77	29	17.14	1.16	270.26
15	26.29	5.89	143.58	30	16.76	1.04	257.08
16	+26.25	+5.81	130.39	Dec. 1	+16.38	+0.91	243.90
17	26.21	5.74	117.20	2	16.00	0.78	230.72
18	26.16	5.66	104.01	3	15.61	0.65	217.54
19	26.11	5.58	90.82	4	15.21	0.53	204.37
20	26.04	5.50	77.63	5	14.81	0.40	191.19
21	+25.97	+5.42	64.44	6	+14.40	+0.27	178.01
22	25.89	5.33	51.25	7	13.99	0.14	164.83
23	25.80	5.25	38.06	8	13.57	+0.01	151.66
24	25.71	5.16	24.87	9	13.15	-0.11	138.48
25	25.61	5.07	11.68	10	12.72	0.24	125.30
26	+25.50	+4.98	358.50	11	+12.29	-0.37	112.13
27	25.38	4.88	345.31	12	11.85	0.50	98.95
28	25.25	4.79	332.12	13	11.41	0.63	85.77
29	25.12	4.70	318.93	14	10.97	0.75	72.60
30	24.97	4.60	305.75	15	10.52	0.88	59.42
31	+24.82	+4.50	292.56	16	+10.06	-1.01	46.25
Nov. 1	24.67	4.40	279.38	17	9.61	1.14	33.07
2	24.50	4.30	266.19	18	9.15	1.26	19.90
3	24.33	4.20	253.00	19	8.68	1.39	6.72
4	24.15	4.09	239.82	20	8.22	1.51	353.55
5	+23.96	+3.99	226.63	21	+ 7.75	-1.64	340.38
6	23.76	3.88	213.45	22	7.28	1.76	327.20
7	23.55	3.77	200.26	23	6.80	1.89	314.03
8	23.34	3.66	187.08	24	6.33	2.01	300.86
9	23.12	3.55	173.90	25	5.85	2.14	287.68
10	+22.89	+3.44	160.71	26	+ 5.37	-2.26	274.51
11	22.65	3.33	147.53	27	4.89	2.38	261.34
12	22.41	3.22	134.34	28	4.41	2.50	248.17
13	22.16	3.10	121.16	29	3.92	2.62	235.00
14	21.90	2.99	107.98	30	3.44	2.74	221.83
15	+21.63	+2.87	94.79	31	+ 2.95	-2.86	208.66
16	+21.36	+2.75	81.61	32	+ 2.46	-2.98	195.49

EPHEMERIS FOR PHYSICAL OBSERVATIONS

TABLE OF AMOUNT TO BE SUBTRACTED FROM L_0 AT 0^h U.T. TO OBTAIN THE VALUE OF L_0 AT ANY UNIVERSAL TIME

U.T.	Daily Motion								
	13.16	13.17	13.18	13.19	13.20	13.21	13.22	13.23	13.24
	°	°	°	°	°	°	°	°	°
h									
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
2	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
3	1.64	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.66
4	2.19	2.20	2.20	2.20	2.20	2.20	2.20	2.21	2.21
5	2.74	2.74	2.75	2.75	2.75	2.75	2.75	2.76	2.76
6	3.29	3.29	3.30	3.30	3.30	3.30	3.30	3.31	3.31
7	3.84	3.84	3.84	3.85	3.85	3.85	3.86	3.86	3.86
8	4.39	4.39	4.39	4.40	4.40	4.40	4.41	4.41	4.41
9	4.93	4.94	4.94	4.95	4.95	4.95	4.96	4.96	4.97
10	5.48	5.49	5.49	5.50	5.50	5.50	5.51	5.51	5.52
11	6.03	6.04	6.04	6.05	6.05	6.05	6.06	6.06	6.07
12	6.58	6.59	6.59	6.59	6.60	6.61	6.61	6.62	6.62
13	7.13	7.13	7.14	7.14	7.15	7.16	7.16	7.17	7.17
14	7.68	7.68	7.69	7.69	7.70	7.71	7.71	7.72	7.72
15	8.22	8.23	8.24	8.24	8.25	8.26	8.26	8.27	8.28
16	8.77	8.78	8.79	8.79	8.80	8.81	8.81	8.82	8.83
17	9.32	9.33	9.34	9.34	9.35	9.36	9.36	9.37	9.38
18	9.87	9.88	9.89	9.89	9.90	9.91	9.91	9.92	9.93
19	10.42	10.43	10.43	10.44	10.45	10.46	10.47	10.47	10.48
20	10.97	10.98	10.98	10.99	11.00	11.01	11.02	11.03	11.03
21	11.51	11.52	11.53	11.54	11.55	11.56	11.57	11.58	11.59
22	12.06	12.07	12.08	12.09	12.10	12.11	12.12	12.13	12.14
23	12.61	12.62	12.63	12.64	12.65	12.66	12.67	12.68	12.69

The following critical table is to be used for all values of the daily motion.

m	m	m	m	m	m	m
00.0 0.00	08.1 0.08	16.9 0.16	25.6 0.24	34.3 0.32	43.0 0.40	51.8 0.48
00.5 .01	09.2 .09	18.0 .17	26.7 .25	35.4 .33	44.1 .41	52.9 .49
01.6 .02	10.3 .10	19.0 .18	27.8 .26	36.5 .34	45.2 .42	54.0 .50
02.7 .03	11.4 .11	20.1 .19	28.9 .27	37.6 .35	46.3 .43	55.0 .51
03.8 .04	12.5 .12	21.2 .20	30.0 .28	38.7 .36	47.4 .44	56.1 .52
04.9 .05	13.6 .13	22.3 .21	31.0 .29	39.8 .37	48.5 .45	57.2 .53
06.0 .06	14.7 .14	23.4 .22	32.1 .30	40.9 .38	49.6 .46	58.3 .54
07.0 .07	15.8 .15	24.5 .23	33.2 .31	42.0 .39	50.7 .47	59.4 .55
08.1	16.9	25.6	34.3	43.0	51.8	60.0

In critical cases ascend.

EPHEMERIS FOR PHYSICAL OBSERVATIONS

SYNODIC ROTATION NUMBERS

Rotation No.	Date of commencement			Rotation No.	Date of commencement			Rotation No.	Date of commencement		
1409	1959	Jan.	2.51	1450	1962	Jan.	24.85	1490	1965	Jan.	19.85
1410		Jan.	29.85	1451		Feb.	21.19	1491		Feb.	16.19
1411		Feb.	26.19	1452		Mar.	20.51	1492		Mar.	15.52
1412		Mar.	25.51	1453		Apr.	16.80	1493		Apr.	11.81
1413		Apr.	21.79	1454		May	14.04	1494		May	9.06
1414		May	19.02	1455		June	10.24	1495		June	5.27
1415		June	15.22	1456		July	7.44	1496		July	2.46
1416		July	12.42	1457		Aug.	3.65	1497		July	29.67
1417		Aug.	8.64	1458		Aug.	30.89	1498		Aug.	25.90
1418		Sept.	4.88	1459		Sept.	27.16	1499		Sept.	22.16
1419		Oct.	2.15	1460		Oct.	24.44	1500		Oct.	19.45
1420		Oct.	29.44	1461		Nov.	20.75	1501		Nov.	15.75
1421		Nov.	25.75	1462		Dec.	18.07	1502		Dec.	13.07
1422		Dec.	23.07	1463	1963	Jan.	14.40	1503	1966	Jan.	9.40
1423	1960	Jan.	19.40	1464		Feb.	10.74	1504		Feb.	5.74
1424		Feb.	15.75	1465		Mar.	10.08	1505		Mar.	5.08
1425		Mar.	14.07	1466		Apr.	6.38	1506		Apr.	1.38
1426		Apr.	10.37	1467		May	3.63	1507		Apr.	28.65
1427		May	7.62	1468		May	30.85	1508		May	25.87
1428		June	3.83					1509		June	22.07
1429		July	1.03	1469		June	27.05	1510		July	19.27
1430		July	28.23	1470		July	24.25	1511		Aug.	15.50
1431		Aug.	24.46	1471		Aug.	20.48	1512		Sept.	11.75
1432		Sept.	20.72	1472		Sept.	16.73	1513		Oct.	9.02
1433		Oct.	18.01	1473		Oct.	14.02	1514		Nov.	5.32
1434		Nov.	14.31	1474		Nov.	10.31	1515		Dec.	2.63
1435		Dec.	11.63	1475		Dec.	7.63	1516		Dec.	29.95
1436	1961	Jan.	7.96	1476	1964	Jan.	3.95	1517	1967	Jan.	26.29
1437		Feb.	4.30	1477		Jan.	31.29	1518		Feb.	22.63
1438		Mar.	3.63	1478		Feb.	27.63	1519		Mar.	21.95
1439		Mar.	30.94	1479		Mar.	25.95	1520		Apr.	18.24
1440		Apr.	27.21	1480		Apr.	22.22	1521		May	15.48
1441		May	24.44	1481		May	19.46	1522		June	11.68
1442		June	20.64	1482		June	15.66	1523		July	8.88
1443		July	17.84	1483		July	12.86	1524		Aug.	5.09
1444		Aug.	14.06	1484		Aug.	9.07	1525		Sept.	1.33
1445		Sept.	10.31	1485		Sept.	5.32	1526		Sept.	28.60
1446		Oct.	7.58	1486		Oct.	2.59	1527		Oct.	25.89
1447		Nov.	3.88	1487		Oct.	29.88	1528		Nov.	22.19
1448		Dec.	1.19	1488		Nov.	26.19	1529		Dec.	19.51
1449		Dec.	28.51	1489		Dec.	23.51				

The synodic rotations are numbered in continuation of Carrington's Greenwich Photo-heliographic series, of which No. 1 commenced on 1853 November 9.

EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h UNIVERSAL TIME

Date	Age	The Earth's Selenographic		Physical Libration	The Sun's Selenographic		Position Angle of		Frac- tion Illuminated
		Longitude	Latitude	Lg. Lt. P.A.	Colong.	Lat.	Axis	Bright Limb	
<div>°01</div>									
Jan.	0	18.9 ^d -2.08 [°]	-6.55 [°]	0 +3 +1	134.51 [°]	-1.25 [°]	19.00 [°]	103.7 [°]	0.87
	1	19.9 [°] -0.93 ^{+1.15}	6.15 ^{+0.40}	0 3 2	146.64 [°]	1.27 [°]	21.35 ^{+2.35}	108.7 ^{+5.0}	0.78
	2	20.9 [°] +0.18 ^{1.11}	5.37 ^{0.78}	0 3 2	158.78 [°]	1.29 [°]	22.39 ^{+1.04}	111.7 ^{3.0}	0.68
	3	21.9 [°] 1.21 ^{1.03}	4.25 ^{1.12}	0 3 2	170.93 [°]	1.30 [°]	22.21 ^{-0.18}	112.9 ^{+1.2}	0.57
	4	22.9 [°] 2.11 ^{0.90}	2.88 ^{1.37}	+1 3 2	183.09 [°]	1.32 [°]	20.92 ^{1.29}	112.5 ^{-0.4}	0.45
							2.33	2.1	
	5	23.9 [°] +2.88 ^{+0.63}	-1.35 ^{+1.60}	+1 +3 +2	195.25 [°]	-1.34 [°]	18.59 ^{-3.33}	110.4 ^{-3.7}	0.34
	6	24.9 [°] 3.51 ^{0.51}	+0.25 ^{1.56}	1 3 2	207.42 [°]	1.35 [°]	15.26 ^{4.27}	106.7 ^{5.5}	0.24
	7	25.9 [°] 4.02 ^{0.37}	1.81 ^{1.45}	1 3 2	219.59 [°]	1.37 [°]	10.99 ^{5.06}	101.2 ^{-7.6}	0.15
	8	26.9 [°] 4.39 ^{0.24}	3.26 ^{1.25}	1 3 2	231.77 [°]	1.39 [°]	5.93 ^{5.56}	93.6 ^{..}	0.08
	9	27.9 [°] 4.63 ^{+0.06}	4.51 ^{0.99}	1 3 2	243.96 [°]	1.40 [°]	0.37 ^{5.63}	82.8 ^{..}	0.03
	10	28.9 [°] +4.69 ^{-0.13}	+5.50 ^{+0.68}	+1 +3 +2	256.14 [°]	-1.42 [°]	354.74 ^{-5.21}	61.0 ^{..}	0.01
	11	0.2 [°] 4.56 ^{0.35}	6.18 ^{0.36}	1 3 2	268.33 [°]	1.43 [°]	349.53 ^{4.41}	318.1 ^{..}	0.00
	12	1.2 [°] 4.21 ^{0.60}	6.54 ^{+0.03}	1 3 2	280.52 [°]	1.45 [°]	345.12 ^{3.40}	273.6 ^{..}	0.02
	13	2.2 [°] 3.61 ^{0.83}	6.57 ^{-0.28}	1 3 2	292.71 [°]	1.46 [°]	341.72 ^{2.34}	261.6 ^{-6.5}	0.05
	14	3.2 [°] 2.78 ^{1.06}	6.29 ^{0.55}	+1 3 2	304.89 [°]	1.47 [°]	339.38 ^{1.35}	255.1 ^{4.0}	0.10
15	4.2 [°] +1.72 ^{-1.23}	+5.74 ^{-0.80}	0 +3 +2	317.07 [°]	-1.47 [°]	338.03 ^{-0.44}	251.1 ^{-2.3}	0.17	
16	5.2 [°] +0.49 ^{1.35}	4.94 ^{1.00}	0 3 1	329.25 [°]	1.48 [°]	337.59 ^{+0.38}	248.8 ^{-1.0}	0.25	
17	6.2 [°] -0.86 ^{1.39}	3.94 ^{1.17}	0 3 1	341.42 [°]	1.49 [°]	337.97 ^{1.15}	247.8 ^{+0.2}	0.33	
18	7.2 [°] 2.25 ^{1.34}	2.77 ^{1.30}	0 3 1	353.59 [°]	1.49 [°]	339.12 ^{1.92}	248.0 ^{1.5}	0.42	
19	8.2 [°] 3.59 ^{1.19}	1.47 ^{1.38}	0 3 1	5.75 [°]	1.49 [°]	341.04 ^{2.70}	249.5 ^{2.7}	0.52	
20	9.2 [°] -4.78 ^{-0.95}	+0.09 ^{-1.40}	0 +3 +1	17.90 [°]	-1.50 [°]	343.74 ^{+3.54}	252.2 ^{+4.0}	0.61	
21	10.2 [°] 5.73 ^{0.60}	-1.31 ^{1.38}	0 3 1	30.05 [°]	1.50 [°]	347.28 ^{4.38}	256.2 ^{5.6}	0.70	
22	11.2 [°] 6.33 ^{-0.20}	2.69 ^{1.28}	0 3 1	42.19 [°]	1.51 [°]	351.66 ^{5.17}	261.8 ^{7.2}	0.79	
23	12.2 [°] 6.53 ^{+0.25}	3.97 ^{1.10}	0 3 1	54.33 [°]	1.51 [°]	356.83 ^{5.70}	269.0 ^{+9.3}	0.87	
24	13.2 [°] 6.28 ^{0.70}	5.07 ^{0.84}	-1 2 1	66.46 [°]	1.51 [°]	2.53 ^{5.76}	278.3 ^{..}	0.93	
25	14.2 [°] -5.58 ^{+1.11}	-5.91 ^{-0.49}	-1 +2 +1	78.59 [°]	-1.51 [°]	8.29 ^{+5.26}	292.2 ^{..}	0.98	
26	15.2 [°] 4.47 ^{1.41}	6.40 ^{-0.10}	1 2 1	90.72 [°]	1.52 [°]	13.55 ^{4.22}	335.9 ^{..}	1.00	
27	16.2 [°] 3.06 ^{1.58}	6.50 ^{+0.33}	1 2 2	102.84 [°]	1.52 [°]	17.77 ^{2.89}	81.1 ^{..}	0.99	
28	17.2 [°] -1.48 ^{1.60}	6.17 ^{0.75}	-1 2 2	114.97 [°]	1.52 [°]	20.66 ^{1.50}	100.4 ^{+7.1}	0.96	
29	18.2 [°] +0.12 ^{1.50}	5.42 ^{1.10}	0 2 2	127.10 [°]	1.52 [°]	22.16 ^{+0.18}	107.5 ^{3.3}	0.90	
30	19.2 [°] +1.62 ^{+1.28}	-4.32 ^{+1.37}	0 +2 +2	139.24 [°]	-1.51 [°]	22.34 ^{-1.01}	110.8 ^{+0.8}	0.81	
31	20.2 [°] 2.90 ^{1.03}	2.95 ^{1.54}	0 2 2	151.38 [°]	1.51 [°]	21.33 ^{2.11}	111.6 ^{-1.1}	0.72	
Feb.	1	21.2 [°] 3.93 ^{0.75}	-1.41 ^{1.59}	0 2 2	163.53 [°]	1.51 [°]	19.22 ^{3.11}	110.5 ^{2.9}	0.61
	2	22.2 [°] 4.68 ^{0.49}	+0.18 ^{1.56}	0 2 2	175.68 [°]	1.51 [°]	16.11 ^{4.05}	107.6 ^{4.4}	0.50
	3	23.2 [°] 5.17 ^{0.26}	1.74 ^{1.43}	0 2 2	187.85 [°]	1.52 [°]	12.06 ^{4.84}	103.2 ^{5.8}	0.39
	4	24.2 [°] +5.43 ^{+0.05}	+3.17 ^{+1.24}	0 +2 +2	200.02 [°]	-1.52 [°]	7.22 ^{-5.39}	97.4 ^{-7.1}	0.28
	5	25.2 [°] 5.48 ^{-0.12}	4.41 ^{0.98}	0 2 2	212.19 [°]	1.52 [°]	1.83 ^{5.56}	90.3 ^{8.0}	0.19
	6	26.2 [°] 5.36 ^{0.30}	5.39 ^{0.70}	0 3 2	224.38 [°]	1.52 [°]	356.27 ^{5.28}	82.3 ^{-9.3}	0.12
	7	27.2 [°] 5.06 ^{0.46}	6.09 ^{0.39}	0 3 2	236.56 [°]	1.53 [°]	350.99 ^{4.61}	73.0 ^{..}	0.06
	8	28.2 [°] 4.60 ^{0.63}	6.48 ^{+0.06}	0 3 2	248.76 [°]	1.53 [°]	346.38 ^{3.67}	60.5 ^{..}	0.02
	9	29.2 [°] +3.97 ^{-0.82}	+6.54 ^{-0.24}	0 +3 +2	260.95 [°]	-1.53 [°]	342.71 ^{-2.66}	28.3 ^{..}	0.00
	10	0.6 [°] 3.15 ^{1.00}	6.30 ^{0.52}	0 3 2	273.14 [°]	1.53 [°]	340.05 ^{1.65}	287.1 ^{..}	0.00
	11	1.6 [°] 2.15 ^{1.16}	5.78 ^{0.78}	0 3 2	285.34 [°]	1.53 [°]	338.40 ^{-0.72}	261.4 ^{-7.7}	0.02
	12	2.6 [°] +0.99 ^{1.30}	5.00 ^{0.98}	0 3 2	297.53 [°]	1.52 [°]	337.68 ^{+0.12}	253.7 ^{3.4}	0.06
	13	3.6 [°] -0.31 ^{1.39}	4.02 ^{1.16}	-1 3 1	309.72 [°]	1.52 [°]	337.80 ^{0.90}	250.3 ^{-1.2}	0.11
	14	4.6 [°] -1.70 ^{-1.43}	+2.86 ^{-1.28}	-1 +3 +1	321.91 [°]	-1.51 [°]	338.70 ^{+1.64}	249.1 ^{+0.4}	0.18
15	5.6 [°] -3.13 ^{..}	+1.58 ^{..}	-1 +3 +1	334.09 [°]	-1.51 [°]	340.34 ^{..}	249.5 ^{..}	0.26	

EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h UNIVERSAL TIME

Date	Age	The Earth's Selenographic		Physical Libration	The Sun's Selenographic		Position Angle of		Fraction Illuminated
		Longitude	Latitude	Lg. Lt. P.A.	Colong.	Lat.	Axis	Bright Limb	
		^d °	[°] °	(0°01)	[°] °	[°] °	[°] °	[°] °	
Feb. 15	5.6	-3.13	+1.58	-1 +3 +1	334.09	-1.51	340.34	249.5	0.26
16	6.6	4.50 -1.37	+0.23 -1.35	1 2 1	346.27	1.50	342.75 +2.41	251.2 +1.7	0.34
17	7.6	5.73 1.23	-1.15 1.38	1 2 1	358.44	1.49	345.94 3.19	254.3 3.1	0.44
18	8.6	6.73 1.00	2.50 1.35	1 2 1	10.61	1.48	349.94 4.00	258.6 4.3	0.53
19	9.6	7.39 0.66	3.77 1.27	1 2 1	22.77	1.47	354.72 4.78	264.2 5.6	0.63
		-0.24	1.12				5.40	6.8	
20	10.6	-7.63	-4.89	-1 +2 +1	34.93	-1.46	0.12	271.0	0.73
21	11.6	7.39 +0.24	5.77 -0.88	1 2 1	47.07	1.44	5.81 +5.69	278.7 +7.7	0.82
22	12.6	6.63 0.76	6.36 0.59	1 2 1	59.22	1.43	11.29 5.48	287.2 8.5	0.90
23	13.6	5.40 1.23	6.57 -0.21	1 2 2	71.36	1.41	15.99 4.70	297.1 +9.9	0.95
24	14.6	3.78 1.62	6.35 +0.22	1 2 2	83.49	1.40	19.52 3.53	314.9	0.99
		1.89	0.66				2.14	..	
25	15.6	-1.89	-5.69	-1 +2 +2	95.63	-1.38	21.66	62.6	1.00
26	16.6	+0.07 +1.96	4.63 +1.06	1 2 2	107.77	1.36	22.39 +0.73	102.5	0.98
27	17.6	1.88	3.25 1.38	1 2 2	119.91	1.34	21.81 -0.58	109.1 +6.6	0.92
28	18.6	3.95 1.64	-1.66 1.59	1 2 2	132.05	1.32	20.02 1.79	110.3 +1.2	0.85
Mar. 1	19.6	4.91 1.32	+0.01 1.67	1 2 2	144.20	1.31	17.13 2.89	108.7 -1.6	0.76
		0.96	1.63				3.90	3.6	
2	20.6	+5.87	+1.64	-1 +2 +2	156.36	-1.29	13.23	105.1	0.65
3	21.6	6.46 +0.59	3.13 +1.49	1 2 2	168.52	1.28	8.47 -4.76	100.0 -5.1	0.54
4	22.6	6.71 +0.25	4.42 1.29	0 2 2	180.70	1.26	3.12 5.35	93.8 6.2	0.43
5	23.6	6.66 -0.05	5.43 1.01	0 2 2	192.88	1.25	357.55 5.57	86.9 6.9	0.33
6	24.6	6.34 0.32	6.15 0.72	0 2 2	205.06	1.24	352.19 5.36	79.9 7.0	0.24
		0.54	0.41				4.75	6.9	
7	25.6	+5.80	+6.56	0 +2 +2	217.25	-1.23	347.44	73.0	0.16
8	26.6	5.07 -0.73	6.65 +0.09	-1 2 2	229.45	1.22	343.56 -3.88	66.4 -6.6	0.09
9	27.6	4.18 0.89	6.43 -0.22	1 2 2	241.65	1.21	340.68 2.88	59.5 -6.9	0.05
10	28.6	3.13 1.05	5.93 0.50	1 2 2	253.86	1.20	338.79 1.89	49.3	0.01
11	29.6	1.95 1.18	5.17 0.76	1 2 2	266.07	1.19	337.82 0.97	4.4	0.00
		1.28	0.98				-0.11	..	
12	0.8	+0.67	+4.19	-1 +2 +2	278.27	-1.17	337.71	266.1	0.01
13	1.8	-0.70 -1.37	3.03 -1.16	1 2 1	290.48	1.16	338.39 +0.68	253.4	0.03
14	2.8	2.12 1.42	1.74 1.29	1 2 1	302.69	1.14	339.82 1.43	250.5 -2.9	0.07
15	3.8	3.53 1.41	+0.37 1.37	1 2 1	314.89	1.13	342.00 2.18	250.7 +0.2	0.12
16	4.8	4.88 1.35	-1.02 1.39	1 2 1	327.09	1.11	344.94 2.94	252.7 2.0	0.19
		1.21	1.36				3.71	3.5	
17	5.8	-6.09	-2.38	-1 +2 +1	339.29	-1.09	348.65	256.2	0.27
18	6.8	7.09 -1.00	3.65 -1.27	2 2 1	351.48	1.07	353.12 +4.47	261.0 +4.8	0.37
19	7.8	7.78 0.69	4.79 1.14	2 2 1	3.66	1.05	358.23 5.11	266.8 5.8	0.46
20	8.8	8.09 -0.31	5.72 0.93	2 2 1	15.84	1.02	3.72 5.49	273.5 6.7	0.57
21	9.8	7.95 +0.14	6.37 -0.65	2 2 1	28.01	1.00	9.17 5.45	280.4 6.9	0.67
		0.63	-0.32				4.94	6.9	
22	10.8	-7.32	-6.69	-2 +2 +2	40.18	-0.97	14.11	287.3	0.77
23	11.8	6.20 +1.12	6.61 +0.08	2 2 2	52.34	0.94	18.08 +3.97	293.6 +6.3	0.86
24	12.8	4.65 1.55	6.10 0.51	2 2 2	64.50	0.92	20.81 2.73	299.4 5.8	0.93
25	13.8	2.78 1.87	5.16 0.94	1 2 2	76.65	0.89	22.19 1.38	306.5 +7.1	0.98
26	14.8	-0.72 2.06	3.85 1.31	1 2 2	88.81	0.85	22.21 +0.02	349.4	1.00
		2.05	1.60				-1.27	..	
27	15.8	+1.33	-2.25	-1 +2 +2	100.96	-0.82	20.94	104.5	0.99
28	16.8	3.23 +1.90	-0.51 +1.74	1 2 2	113.11	0.79	18.45 -2.49	109.2 +4.7	0.95
29	17.8	4.84 1.61	+1.24 1.75	1 2 2	125.27	0.76	14.82 3.63	107.5 -1.7	0.88
30	18.8	6.08 1.24	2.86 1.62	1 2 2	137.44	0.73	10.19 4.63	103.2 4.3	0.80
31	19.8	6.90 0.82	4.27 1.41	1 2 2	149.61	0.71	4.82 5.37	97.4 5.8	0.70
		0.41	1.12				5.71	6.6	
Apr. 1	20.8	+7.31	+5.39	-1 +2 +2	161.78	-0.68	359.11	90.8	0.59
2	21.8	+7.33 +0.02	+6.19 +0.80	-1 +2 +2	173.97	-0.66	353.53 -5.58	84.0 -6.8	0.49

EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h UNIVERSAL TIME

Date	Age	The Earth's Selenographic			Physical Libration	The Sun's Selenographic		Position Angle of			Frac- tion Illumi- nated			
		Longitude	Latitude		Lg. Lt. P.A.	Colong.	Lat.	Axis	Bright Limb					
		°	°	°	(0°01)	°	°	°	°	°				
Apr.	1	20.8	+7.31	+0.02	+5.39	+0.80	-1 +2 +2	161.78	-0.68	359.11	-5.58	90.8	-6.8	0.59
	2	21.8	7.33	-0.33	6.19	0.47	1 2 2	173.97	0.66	353.53	4.99	84.0	6.4	0.49
	3	22.8	7.00	0.62	6.66	+0.13	1 2 2	186.16	0.64	348.54	4.12	77.6	5.6	0.39
	4	23.8	6.38	0.87	6.79	-0.17	1 2 2	198.36	0.62	344.42	3.12	72.0	4.8	0.29
	5	24.8	5.51	1.07	6.62	0.48	1 2 2	210.57	0.60	341.30	2.12	67.2	3.8	0.21
	6	25.8	+4.44	-1.21	+6.14	-0.73	-1 +2 +2	222.78	-0.58	339.18	-1.17	63.4	-3.0	0.13
	7	26.8	3.23	1.31	5.41	0.96	1 2 2	234.99	0.56	338.01	-0.32	60.4	2.7	0.08
	8	27.8	1.92	1.38	4.45	1.15	1 2 2	247.21	0.54	337.69	+0.48	57.7	-4.8	0.03
	9	28.8	+0.54	1.40	3.30	1.29	1 2 2	259.44	0.53	338.17	1.23	52.9	..	0.01
	10	0.1	-0.86	1.40	2.01	1.38	1 2 2	271.66	0.51	339.40	1.98	311.7	..	0.00
	11	1.1	-2.26	-1.33	+0.63	-1.42	-1 +2 +1	283.88	-0.49	341.38	+2.75	252.0	-1.0	0.01
	12	2.1	3.59	1.24	-0.79	1.39	1 2 1	296.11	0.46	344.13	3.51	251.0	+2.6	0.04
	13	3.1	4.83	1.08	2.18	1.31	2 2 1	308.33	0.44	347.64	4.28	253.6	4.2	0.08
	14	4.1	5.91	0.88	3.49	1.16	2 2 1	320.55	0.42	351.92	4.92	257.8	5.4	0.14
	15	5.1	6.79	0.61	4.65	0.97	2 2 1	332.76	0.39	356.84	5.33	263.2	6.3	0.22
	16	6.1	-7.40	-0.29	-5.62	-0.72	-2 +2 +2	344.97	-0.37	2.17	+5.39	269.5	+6.5	0.31
	17	7.1	7.69	+0.08	6.34	0.40	2 2 2	357.18	0.34	7.56	5.00	276.0	6.5	0.41
	18	8.1	7.61	0.49	6.74	-0.04	2 2 2	9.38	0.31	12.56	4.21	282.5	5.7	0.51
	19	9.1	7.12	0.91	6.78	+0.36	2 2 2	21.57	0.28	16.77	3.11	288.2	4.7	0.62
	20	10.1	6.21	1.29	6.42	0.77	2 2 2	33.76	0.25	19.88	1.87	292.9	3.5	0.73
	21	11.1	-4.92	+1.62	-5.65	+1.16	-2 +2 +2	45.94	-0.21	21.75	+0.59	296.4	+2.0	0.83
	22	12.1	3.30	1.84	4.49	1.49	1 2 2	58.11	0.18	22.34	-0.68	298.4	0.6	0.91
	23	13.1	-1.46	1.94	3.00	1.71	1 2 2	70.28	0.14	21.66	1.91	299.0	+0.2	0.97
	24	14.1	+0.48	1.89	-1.29	1.80	1 2 2	82.45	0.10	19.75	3.13	299.2	..	1.00
	25	15.1	2.37	1.70	+0.51	1.74	1 2 2	94.62	0.07	16.62	4.28	111.3	-3.0	1.00
	26	16.1	+4.07	+1.40	+2.25	+1.56	-1 +2 +2	106.79	-0.03	12.34	-5.23	108.3	-5.7	0.97
	27	17.1	5.47	1.02	3.81	1.28	1 2 2	118.96	+0.01	7.11	5.82	102.6	6.7	0.91
	28	18.1	6.49	0.60	5.09	0.94	1 2 2	131.14	0.04	1.29	5.86	95.9	7.1	0.83
	29	19.1	7.09	+0.16	6.03	0.58	1 2 2	143.33	0.07	355.43	5.38	88.8	6.8	0.74
	30	20.1	7.25	-0.24	6.61	+0.23	1 2 2	155.52	0.09	350.05	4.51	82.0	5.9	0.65
May	1	21.1	+7.01	-0.60	+6.84	-0.11	-1 +2 +2	167.72	+0.12	345.54	-3.46	76.1	-4.9	0.54
	2	22.1	6.41	0.89	6.73	0.41	1 2 2	179.92	0.14	342.08	2.40	71.2	3.7	0.44
	3	23.1	5.52	1.13	6.32	0.69	1 2 2	192.13	0.16	339.68	1.42	67.5	2.5	0.35
	4	24.1	4.39	1.29	5.63	0.92	1 2 2	204.35	0.19	338.26	-0.54	65.0	1.4	0.26
	5	25.1	3.10	1.38	4.71	1.11	1 2 2	216.57	0.21	337.72	+0.27	63.6	-0.3	0.18
	6	26.1	+1.72	-1.41	+3.60	-1.27	-1 +2 +2	228.80	+0.22	337.99	+1.03	63.3	+1.0	0.11
	7	27.1	+0.31	1.39	2.33	1.37	1 2 2	241.03	0.24	339.02	1.78	64.3	2.7	0.06
	8	28.1	-1.08	1.31	+0.96	1.42	1 2 2	253.27	0.26	340.80	2.55	67.0	-7.8	0.02
	9	29.1	2.39	1.19	-0.46	1.41	1 2 2	265.51	0.28	343.35	3.33	74.8	..	0.00
	10	0.4	3.58	1.04	1.87	1.34	1 2 2	277.75	0.30	346.68	4.12	236.2	..	0.00
	11	1.4	-4.62	-0.85	-3.21	-1.21	-1 +1 +2	289.99	+0.33	350.80	+4.81	250.5	+7.2	0.02
	12	2.4	5.47	0.63	4.42	1.01	1 1 2	302.22	0.35	355.61	5.28	257.7	7.0	0.05
	13	3.4	6.10	0.38	5.43	0.77	1 1 2	314.46	0.37	0.89	5.40	264.7	7.0	0.11
	14	4.4	6.48	-0.13	6.20	0.46	1 1 2	326.69	0.39	6.29	5.09	271.7	6.7	0.18
	15	5.4	6.61	+0.17	6.66	-0.12	1 1 2	338.92	0.42	11.38	4.36	278.4	5.9	0.27
	16	6.4	-6.44	+0.45	-6.78	+0.25	-1 +1 +2	351.14	+0.44	15.74	+3.34	284.3	+4.9	0.37
	17	7.4	-5.99		-6.53		-1 +1 +2	3.36	+0.47	19.08		289.2		0.48

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	Age	The Earth's Selenographic		Physical Libration	The Sun's Selenographic		Position Angle of		Fraction Illuminated
		Longitude	Latitude	Lg. Lt. P.A.	Colong.	Lat.	Axis	Bright Limb	
		°	°	(0°01)	°	°	°	°	
May 17	7.4	-5.99	-6.53	-1 +1 +2	3.36	+0.47	19.08	289.2	0.48
18	8.4	5.24	5.89	1 1 2	15.57	0.50	21.26	292.8	0.59
19	9.4	4.21	4.88	1 1 2	27.77	0.53	22.25	294.9	0.70
20	10.4	2.93	3.54	1 1 2	39.96	0.57	22.05	295.4	0.80
21	11.4	-1.45	1.96	1 1 2	52.15	0.60	20.67	294.0	0.89
22	12.4	+0.14	-0.22	-1 +1 +2	64.34	+0.64	18.11	290.0	0.95
23	13.4	1.77	+1.53	-1 1 2	76.52	0.67	14.37	280.3	0.99
24	14.4	3.30	3.16	0 1 2	88.71	0.70	9.54	150.3	1.00
25	15.4	4.63	4.57	0 1 2	100.89	0.74	3.88	107.3	0.98
26	16.4	5.67	5.65	0 1 2	113.08	0.77	357.87	96.5	0.94
27	17.4	+6.33	+6.38	0 +1 +2	125.27	+0.79	352.11	88.1	0.87
28	18.4	6.58	6.73	0 1 2	137.46	0.82	347.12	81.0	0.79
29	19.4	6.42	6.72	0 1 2	149.66	0.84	343.19	75.2	0.70
30	20.4	5.87	6.39	0 1 2	161.87	0.86	340.38	70.9	0.61
31	21.4	5.00	5.76	0 1 2	174.08	0.88	338.63	67.8	0.51
June 1	22.4	+3.87	+4.89	0 +1 +2	186.30	+0.90	337.82	66.0	0.41
2	23.4	2.56	3.83	0 1 2	198.52	0.91	337.86	65.4	0.32
3	24.4	+1.17	2.60	0 1 2	210.76	0.93	338.66	66.0	0.24
4	25.4	-0.24	+1.27	-1 1 2	222.99	0.94	340.22	67.8	0.16
5	26.4	1.57	-0.13	1 1 2	235.23	0.96	342.53	71.1	0.10
6	27.4	-2.77	-1.53	-1 +1 +2	247.48	+0.97	345.64	76.6	0.05
7	28.4	3.79	2.88	1 1 2	259.73	0.99	349.56	86.9	0.02
8	29.4	4.58	4.11	1 1 2	271.97	1.00	354.23	134.3	0.00
9	0.8	5.12	5.17	1 1 2	284.22	1.02	359.47	245.2	0.01
10	1.8	5.40	5.98	1 1 2	296.47	1.03	4.94	262.5	0.03
11	2.8	-5.44	-6.50	-1 +1 +2	308.72	+1.05	10.19	272.3	0.08
12	3.8	5.24	6.67	1 1 2	320.96	1.06	14.78	279.8	0.15
13	4.8	4.85	6.48	1 1 2	333.20	1.08	18.37	285.6	0.24
14	5.8	4.27	5.91	1 1 2	345.43	1.10	20.82	290.0	0.34
15	6.8	3.52	4.99	1 1 2	357.66	1.12	22.08	292.7	0.45
16	7.8	-2.64	-3.76	-1 +1 +2	9.88	+1.14	22.20	293.8	0.56
17	8.8	1.62	2.29	0 1 2	22.09	1.16	21.20	293.3	0.67
18	9.8	-0.49	-0.66	0 1 2	34.30	1.19	19.09	291.0	0.78
19	10.8	+0.71	+1.02	0 1 2	46.50	1.21	15.86	286.5	0.87
20	11.8	1.93	2.63	0 1 2	58.69	1.24	11.52	279.4	0.94
21	12.8	+3.11	+4.07	0 +1 +2	70.88	+1.26	6.24	266.7	0.98
22	13.8	4.16	5.24	0 1 2	83.07	1.29	0.35	215.5	1.00
23	14.8	4.99	6.07	0 1 2	95.26	1.31	354.43	109.0	0.99
24	15.8	5.52	6.53	+1 1 2	107.46	1.33	349.04	90.9	0.96
25	16.8	5.71	6.62	1 1 2	119.65	1.35	344.62	81.6	0.91
26	17.8	+5.52	+6.37	+1 +1 +2	131.85	+1.36	341.34	75.3	0.84
27	18.8	4.96	5.81	0 1 2	144.05	1.37	339.18	71.1	0.76
28	19.8	4.09	4.99	0 1 2	156.26	1.39	338.04	68.4	0.67
29	20.8	2.96	3.97	0 1 2	168.48	1.39	337.79	67.0	0.57
30	21.8	1.65	2.78	0 1 2	180.70	1.40	338.34	66.8	0.48
July 1	22.8	+0.26	+1.49	0 +1 +2	192.92	+1.41	339.64	67.8	0.39
2	23.8	-1.13	+0.12	0 +1 +2	205.16	+1.41	341.70	70.1	0.30

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	Age	The Earth's Selenographic		Physical Libration	The Sun's Selenographic		Position Angle of		Fraction Illuminated			
		Longitude	Latitude	Ig. Lt. P.A.	Colong.	Lat.	Axis	Bright Limb				
July	1	22.8 ^d	+0.26 ^o	+1.49 ^o	0 01	+2	192.92 ^o	+1.41 ^o	339.64 ^o	67.8 ^o	0.39	
	2	23.8	-1.13 ^{-1.39}	+0.12 ^{-1.37}	0 1	2	205.16	1.41	341.70 ^{+2.06}	70.1 ^{+2.3}	0.30	
	3	24.8	2.41 ^{1.28}	-1.25 ^{1.37}	0 1	2	217.39	1.42	344.53 ^{2.83}	73.7 ^{3.6}	0.21	
	4	25.8	3.51 ^{1.10}	2.59 ^{1.34}	0 1	2	229.64	1.42	348.18 ^{3.65}	78.8 ^{5.1}	0.14	
	5	26.8	4.36 ^{0.85}	3.83 ^{1.24}	0 1	2	241.88	1.43	352.62 ^{4.44}	86.0 ^{+7.2}	0.08	
			0.55 ^{1.08}						5.11			
	6	27.8	-4.91 ^{-0.23}	-4.91 ^{-0.85}	0 01	+2	254.13	+1.43	357.73 ^{+5.49}	96.6 ^{..}	0.03	
	7	28.8	5.14 ^{+0.08}	5.76 ^{0.57}	0 1	2	266.39	1.44	3.22 ^{5.45}	119.2 ^{..}	0.01	
	8	0.3	5.06 ^{0.37}	6.33 ^{-0.23}	0 1	2	278.64	1.44	8.67 ^{4.89}	225.0 ^{..}	0.00	
	9	1.3	4.69 ^{0.60}	6.56 ^{+0.15}	0 1	2	290.89	1.44	13.56 ^{3.95}	266.7 ^{..}	0.02	
	10	2.3	4.09 ^{0.77}	6.41 ^{0.52}	0 1	2	303.14	1.45	17.51 ^{2.78}	279.0 ^{+6.9}	0.06	
	11	3.3	-3.32 ^{+0.86}	-5.89 ^{+0.89}	0 01	+2	315.39	+1.45	20.29 ^{+1.56}	285.9 ^{+4.2}	0.13	
	12	4.3	2.46 ^{0.92}	5.00 ^{1.19}	0 1	2	327.63	1.46	21.85 ^{+0.39}	290.1 ^{2.2}	0.21	
	13	5.3	1.54 ^{0.92}	3.81 ^{1.42}	0 1	2	339.87	1.46	22.24 ^{-0.73}	292.3 ^{+0.3}	0.31	
	14	6.3	-0.62 ^{0.92}	2.39 ^{1.58}	0 1	2	352.10	1.47	21.51 ^{1.81}	292.6 ^{-1.3}	0.42	
	15	7.3	+0.30 ^{0.91}	-0.81 ^{1.62}	0 1	2	4.32	1.48	19.70 ^{2.88}	291.3 ^{3.2}	0.54	
	16	8.3	+1.21 ^{+0.88}	+0.81 ^{+1.57}	+1 1	2	16.54	+1.49	16.82 ^{-3.93}	288.1 ^{-4.9}	0.65	
	17	9.3	2.09 ^{0.84}	2.38 ^{1.42}	1 1	2	28.74	1.50	12.89 ^{4.91}	283.2 ^{6.8}	0.76	
	18	10.3	2.93 ^{0.78}	3.80 ^{1.18}	1 1	2	40.95	1.52	7.98 ^{5.61}	276.4 ^{-8.9}	0.85	
	19	11.3	3.71 ^{0.65}	4.98 ^{0.88}	1 1	2	53.14	1.53	2.37 ^{5.87}	267.5 ^{..}	0.92	
20	12.3	4.36 ^{0.48}	5.86 ^{0.52}	1 1	2	65.34	1.54	356.50 ^{5.56}	255.3 ^{..}	0.97		
	21	13.3	+4.84 ^{+0.24}	+6.38 ^{+0.17}	+1 1	2	77.53	+1.55	350.94 ^{-4.78}	228.8 ^{..}	0.99	
	22	14.3	5.08 ^{-0.03}	6.55 ^{-0.19}	1 1	2	89.72	1.55	346.16 ^{3.70}	122.2 ^{..}	1.00	
	23	15.3	5.05 ^{0.35}	6.36 ^{0.50}	1 1	2	101.91	1.56	342.46 ^{2.57}	87.6 ^{..}	0.98	
	24	16.3	4.70 ^{0.66}	5.86 ^{0.78}	1 1	2	114.10	1.56	339.89 ^{1.51}	77.3 ^{-5.4}	0.94	
	25	17.3	4.04 ^{0.94}	5.08 ^{1.00}	1 1	2	126.30	1.56	338.38 ^{-0.57}	71.9 ^{2.8}	0.88	
	26	18.3	+3.10 ^{-1.17}	+4.08 ^{-1.16}	+1 1	2	138.50	+1.56	337.81 ^{+0.27}	69.1 ^{-1.3}	0.81	
	27	19.3	1.93 ^{1.33}	2.92 ^{1.28}	1 1	2	150.70	1.56	338.08 ^{1.05}	67.8 ^{+0.2}	0.73	
	28	20.3	+0.60 ^{1.41}	1.64 ^{1.35}	1 1	2	162.91	1.56	339.13 ^{1.79}	68.0 ^{1.4}	0.64	
	29	21.3	-0.81 ^{1.38}	+0.29 ^{1.36}	1 1	2	175.13	1.55	340.92 ^{2.55}	69.4 ^{2.6}	0.55	
	30	22.3	2.19 ^{1.26}	-1.07 ^{1.33}	1 1	2	187.35	1.55	343.47 ^{3.33}	72.0 ^{3.9}	0.45	
	Aug.	31	23.3	-3.45 ^{-1.05}	-2.40 ^{-1.23}	+1 1	2	199.58	+1.54	346.80 ^{+4.13}	75.9 ^{+5.2}	0.36
		1	24.3	4.50 ^{0.75}	3.63 ^{1.10}	1 1	2	211.81	1.53	350.93 ^{4.86}	81.1 ^{6.5}	0.27
		2	25.3	5.25 ^{0.40}	4.73 ^{0.89}	+1 0	2	224.04	1.53	355.79 ^{5.38}	87.6 ^{8.0}	0.19
		3	26.3	5.65 ^{-0.01}	5.62 ^{0.62}	0 0	2	236.29	1.52	1.17 ^{5.53}	95.6 ^{+9.9}	0.11
		4	27.3	5.66 ^{+0.39}	6.24 ^{-0.29}	0 0	2	248.53	1.51	6.70 ^{5.18}	105.5 ^{..}	0.06
		5	28.3	-5.27 ^{+0.73}	-6.53 ^{+0.08}	0 0	2	260.78	+1.50	11.88 ^{+4.36}	120.4 ^{..}	0.02
		6	29.3	4.54 ^{1.00}	6.45 ^{0.47}	+1 0	2	273.03	1.49	16.24 ^{3.25}	179.2 ^{..}	0.00
		7	0.9	3.54 ^{1.18}	5.98 ^{0.85}	1 0	2	285.28	1.48	19.49 ^{1.98}	268.9 ^{..}	0.01
		8	1.9	2.36 ^{1.25}	5.13 ^{1.19}	0 0	2	297.53	1.47	21.47 ^{+0.75}	284.1 ^{+5.5}	0.05
		9	2.9	-1.11 ^{1.24}	3.94 ^{1.44}	1 0	2	309.77	1.47	22.22 ^{-0.44}	289.6 ^{+2.1}	0.11
10		3.9	+0.13 ^{+1.14}	-2.50 ^{+1.59}	+1 0	2	322.01	+1.46	21.78 ^{-1.55}	291.7 ^{-0.3}	0.19	
11		4.9	1.27 ^{1.02}	-0.91 ^{1.64}	1 0	2	334.24	1.45	20.23 ^{2.64}	291.4 ^{2.2}	0.29	
12		5.9	2.29 ^{0.88}	+0.73 ^{1.58}	1 0	2	346.47	1.45	17.59 ^{3.69}	289.2 ^{3.9}	0.40	
13		6.9	3.17 ^{0.73}	2.31 ^{1.43}	1 0	2	358.69	1.44	13.90 ^{4.66}	285.3 ^{5.6}	0.52	
14		7.9	3.90 ^{0.59}	3.74 ^{1.18}	1 0	2	10.90	1.44	9.24 ^{5.39}	279.7 ^{6.8}	0.63	
15		8.9	+4.49 ^{+0.44}	+4.92 ^{+0.90}	+2 0	2	23.10	+1.43	3.85 ^{-5.76}	272.9 ^{-7.9}	0.73	
16	9.9	+4.93	+5.82	+2 +1	2	35.30	+1.43	358.09	265.0	0.82		

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	Age	The Earth's Selenographic		Physical Libration	The Sun's Selenographic		Position Angle of		Fraction Illuminated
		Longitude	Latitude	Lg. Lt. P.A.	Colong.	Lat.	Axis	Bright Limb	
	d	°	°	(0°01)	°	°	°	°	
Aug. 16	9.9	+4.93	+5.82	+2 +1 +2	35.30	+1.43	358.09	265.0	0.82
17	10.9	5.20 +0.27	6.38 +0.56	2 1 2	47.49	1.43	352.50 -5.59	256.5 -8.5	0.90
18	11.9	5.29 +0.09	6.59 +0.21	2 1 2	59.68	1.42	347.54 4.96	246.9 -9.6	0.95
19	12.9	5.17 -0.12	6.45 -0.14	2 1 2	71.87	1.41	343.55 3.99	232.8 .	0.99
20	13.9	4.82 0.35	5.99 0.46	2 1 2	84.05	1.41	340.64 2.91	354.7 .	1.00
		0.61	0.75				1.84		
21	14.9	+4.21	+5.24	+2 +1 +2	96.24	+1.40	338.80	88.7	0.99
22	15.9	3.37 -0.84	4.26 -0.98	2 0 2	108.42	1.38	337.93 -0.87	74.8 .	0.96
23	16.9	2.29 1.08	3.09 1.17	2 0 2	120.61	1.37	337.93 0.00	70.2 -4.6	0.92
24	17.9	+1.04 1.25	1.81 1.28	1 0 2	132.80	1.36	338.72 +0.79	68.6 -1.6	0.86
25	18.9	-0.33 1.37	+0.46 1.35	1 0 2	144.99	1.34	340.25 1.53	68.9 +0.3	0.79
		1.43	1.38				2.29	1.8	
26	19.9	-1.76	-0.92	+1 0 +2	157.19	+1.33	342.54	70.7	0.71
27	20.9	3.15 -1.39	2.25 -1.33	1 0 2	169.39	1.31	345.58 +3.04	73.7 +3.0	0.62
28	21.9	4.42 1.27	3.50 1.25	1 0 2	181.60	1.29	349.40 3.82	77.9 4.2	0.52
29	22.9	5.46 1.04	4.62 1.12	1 0 2	193.81	1.27	353.95 4.55	83.3 5.4	0.43
30	23.9	6.20 0.74	5.54 0.92	1 0 2	206.03	1.26	359.10 5.15	89.8 6.5	0.33
		-0.36	0.68				5.44	7.1	
Sept. 31	24.9	-6.56	-6.22	+1 0 +2	218.26	+1.24	4.54	96.9	0.24
1	25.9	6.49 +0.07	6.60 -0.38	1 0 2	230.49	1.22	9.85 +5.31	104.5 +7.6	0.15
2	26.9	5.98 0.51	6.62 -0.02	1 0 2	242.72	1.20	14.57 4.72	112.4 7.9	0.08
3	27.9	5.04 0.94	6.24 +0.38	1 0 2	254.96	1.18	18.29 3.72	121.7 +9.3	0.03
4	28.9	3.76 1.28	5.47 0.77	1 0 2	267.20	1.16	20.81 2.52	143.9 .	0.00
		1.52	1.15				+1.24		
5	0.5	-2.24	-4.32	+1 0 +2	279.44	+1.14	22.05	268.3	0.00
6	1.5	-0.61 +1.63	2.87 +1.45	1 0 2	291.67	1.12	22.04 -0.01	287.7 .	0.03
7	2.5	+1.00 1.61	-1.23 1.64	1 0 2	303.91	1.10	20.83 1.21	291.0 +3.3	0.09
8	3.5	2.49 1.49	+0.49 1.72	2 0 2	316.14	1.08	18.47 2.36	290.3 -0.7	0.17
9	4.5	3.78 1.29	2.16 1.67	2 0 2	328.36	1.06	14.98 3.49	287.3 3.0	0.27
		1.05	1.50				4.51	4.8	
10	5.5	+4.83	+3.66	+2 0 +2	340.58	+1.04	10.47	282.5	0.37
11	6.5	5.61 +0.78	4.91 +1.25	2 0 2	352.79	1.02	5.16 -5.31	276.3 -6.2	0.49
12	7.5	6.12 0.51	5.86 0.95	2 0 2	4.99	1.01	359.43 5.73	269.3 7.0	0.60
13	8.5	6.37 +0.25	6.46 0.60	2 0 2	17.19	0.99	353.77 5.66	262.0 7.3	0.70
14	9.5	6.37 0.00	6.71 +0.25	2 0 2	29.38	0.97	348.68 5.09	255.1 6.9	0.79
		-0.24	-0.10				4.20	6.4	
15	10.5	+6.13	+6.61	+2 0 +2	41.56	+0.95	344.48	248.7	0.87
16	11.5	5.67 -0.46	6.19 -0.42	2 0 2	53.74	0.93	341.34 -3.14	242.8 -5.9	0.93
17	12.5	4.99 0.68	5.47 0.72	2 0 2	65.91	0.91	339.24 2.10	236.5 -6.3	0.97
18	13.5	4.11 0.88	4.51 0.96	2 0 2	78.08	0.89	338.11 1.13	223.5 .	0.99
19	14.5	3.04 1.07	3.36 1.15	2 0 2	90.26	0.87	337.87 -0.24	105.0 .	1.00
		1.22	1.29				+0.55		
20	15.5	+1.82	+2.07	+2 0 +2	102.43	+0.85	338.42	73.1	0.98
21	16.5	+0.47 -1.35	+0.70 -1.37	2 0 2	114.60	0.82	339.73 +1.31	69.3 -3.8	0.95
22	17.5	-0.94 1.41	-0.70 1.40	2 0 2	126.78	0.80	341.78 2.05	69.5 +0.2	0.90
23	18.5	2.38 1.44	2.06 1.36	1 0 2	138.95	0.77	344.58 2.80	71.6 2.1	0.84
24	19.5	3.76 1.38	3.34 1.28	1 0 2	151.13	0.75	348.14 3.56	75.1 3.5	0.77
		1.26	1.15				4.29	4.8	
25	20.5	-5.02	-4.49	+1 0 +2	163.32	+0.72	352.43	79.9	0.68
26	21.5	6.07 -1.05	5.46 -0.97	1 0 2	175.51	0.70	357.33 +4.90	85.6 +5.7	0.59
27	22.5	6.84 0.77	6.20 0.74	1 0 2	187.71	0.67	2.60 5.27	92.0 6.4	0.49
28	23.5	7.25 -0.41	6.66 -0.46	1 0 2	199.91	0.65	7.89 5.29	98.7 6.7	0.39
29	24.5	7.24 +0.01	6.79 -0.13	1 0 2	212.11	0.62	12.76 4.87	105.2 6.5	0.29
		0.46	+0.24				4.08	5.9	
Oct. 30	25.5	-6.78	-6.55	+1 0 +2	224.33	+0.60	16.84	111.1	0.20
1	26.5	-5.87 +0.91	-5.91 +0.64	+1 0 +2	236.54	+0.57	19.84 +3.00	116.1 +5.0	0.11

EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h UNIVERSAL TIME

Date	Age	The Earth's Selenographic		Physical Libration	The Sun's Selenographic		Position Angle of		Fraction Illuminated
		Longitude	Latitude	Lg. Lt. P.A.	Colong.	Lat.	Axis	Bright Limb	
<div>°(0°01)</div>									
Oct.	1	26.5 ^d -5.87 [°]	-5.91 [°]	+1 0 +2	236.54 [°]	+0.57 [°]	19.84 [°]	116.1 [°]	0.11
	2	27.5 4.55 +1.32	4.89 +1.02	1 0 2	248.77	0.54	21.63 +1.79	120.4 +4.3	0.05
	3	28.5 2.90 1.65	3.51 1.38	1 0 2	260.99	0.52	22.18 +0.55	126.0 +5.6	0.01
	4	0.2 -1.05 1.85	1.87 1.64	1 0 2	273.21	0.49	21.48 -0.70	258.8 . .	0.00
	5	1.2 +0.87 1.92	-0.09 1.78	2 0 2	285.44	0.46	19.56 1.92	290.9 . .	0.02
			1.83 1.77				3.15	-0.8	
	6	2.2 +2.70	+1.68	+2 0 +2	297.66	+0.43	16.41	290.1	0.07
	7	3.2 4.34 +1.64	3.32 +1.64	2 0 2	309.88	0.41	12.11 -4.30	286.1 -4.0	0.14
	8	4.2 5.67 1.33	4.71 1.39	2 0 2	322.09	0.38	6.86 5.25	280.3 5.8	0.23
	9	5.2 6.66 0.99	5.77 1.06	2 0 2	334.29	0.35	1.03 5.83	273.4 6.9	0.34
	10	6.2 7.27 0.61	6.47 0.70	2 0 2	346.49	0.33	355.18 5.85	266.2 7.2	0.45
			+0.23 +0.32				5.34	6.8	
	11	7.2 +7.50	+6.79	+2 0 +2	358.68	+0.30	349.84	259.4	0.55
	12	8.2 7.39 -0.11	6.75 -0.04	2 0 2	10.86	0.27	345.39 -4.45	253.5 -5.9	0.65
	13	9.2 6.95 0.44	6.38 0.37	2 0 2	23.04	0.25	342.00 3.39	248.6 4.9	0.75
	14	10.2 6.25 0.70	5.71 0.67	2 0 2	35.21	0.22	339.68 2.32	244.9 3.7	0.83
	15	11.2 5.31 0.94	4.79 0.92	2 0 2	47.38	0.19	338.33 1.35	242.4 2.5	0.90
			1.11 1.13				-0.46	1.5	
	16	12.2 +4.20	+3.66	+2 0 +2	59.54	+0.16	337.87	240.9	0.95
	17	13.2 2.95 -1.25	2.39 -1.27	2 0 2	71.70	0.14	338.22 +0.35	240.1 -0.8	0.98
	18	14.2 1.60 1.35	+1.02 1.37	2 0 2	83.85	0.11	339.32 1.10	238.0 -2.1	1.00
	19	15.2 +0.19 1.41	-0.39 1.41	2 0 2	96.01	0.08	341.16 1.84	66.9 . .	1.00
	20	16.2 -1.23 1.42	1.78 1.39	1 0 2	108.16	0.05	343.76 2.60	67.8 +0.9	0.98
			1.39 1.32				3.36	3.4	
	21	17.2 -2.62	-3.10	+1 0 +2	120.32	+0.02	347.12	71.2	0.94
	22	18.2 3.93 -1.31	4.29 -1.19	1 -1 2	132.48	-0.01	351.21 +4.09	75.9 +4.7	0.89
	23	19.2 5.11 1.18	5.30 1.01	1 1 2	144.64	0.04	355.93 4.72	81.5 5.6	0.82
	24	20.2 6.11 1.00	6.09 0.79	1 1 2	156.81	0.06	1.07 5.14	87.7 6.2	0.74
	25	21.2 6.86 0.75	6.62 0.53	1 1 2	168.98	0.09	6.30 5.23	94.3 6.6	0.65
			-0.45 -0.21				4.92	6.3	
	26	22.2 -7.31	-6.83	+1 -1 +2	181.15	-0.11	11.22	100.6	0.55
	27	23.2 7.41 -0.10	6.71 +0.12	1 -1 2	193.34	0.14	15.48 +4.26	106.3 +5.7	0.45
	28	24.2 7.11 +0.30	6.22 0.49	1 0 2	205.52	0.17	18.79 3.31	111.0 4.7	0.34
	29	25.2 6.40 0.71	5.36 0.86	1 0 2	217.72	0.19	21.01 2.22	114.5 3.5	0.24
	30	26.2 5.27 1.13	4.15 1.21	1 0 2	229.91	0.22	22.07 +1.06	116.5 2.0	0.15
			1.50 1.52				-0.13	+0.2	
Nov.	31	27.2 -3.77	-2.63	+1 0 +2	242.12	-0.25	21.94	116.7	0.07
	1	28.2 -1.97 +1.80	-0.90 +1.73	1 -1 2	254.33	0.28	20.61 -1.33	114.3 -2.4	0.02
	2	29.2 0.00 1.97	+0.91 1.81	1 1 2	266.53	0.30	18.02 2.59	98.2 . .	0.00
	3	0.8 +2.00 2.00	2.65 1.74	2 1 2	278.74	0.33	14.18 3.84	296.2 . .	0.01
	4	1.8 3.88 1.88	4.20 1.55	2 1 2	290.95	0.36	9.18 5.00	287.3 -8.9	0.05
			1.61 1.23				5.84	7.8	
	5	2.8 +5.49	+5.43	+2 -1 +2	303.15	-0.39	3.34	279.5	0.11
	6	3.8 6.74 +1.25	6.28 +0.85	2 1 2	315.35	0.42	357.23 -6.11	271.6 -7.9	0.19
	7	4.8 7.55 0.81	6.73 0.45	2 1 2	327.54	0.45	351.48 5.75	264.1 7.5	0.29
	8	5.8 7.90 +0.35	6.78 +0.05	2 1 2	339.73	0.48	346.61 4.87	257.6 6.5	0.39
	9	6.8 7.82 -0.08	6.48 -0.30	2 1 2	351.91	0.50	342.84 3.77	252.4 5.2	0.50
			0.49 0.61				2.63	3.9	
	10	7.8 +7.33	+5.87	+2 -1 +2	4.08	-0.53	340.21	248.5	0.60
	11	8.8 6.52 -0.81	4.99 -0.88	2 1 2	16.24	0.56	338.61 -1.60	245.9 -2.6	0.69
	12	9.8 5.45 1.07	3.91 1.08	2 1 2	28.40	0.59	337.93 -0.68	244.6 -1.3	0.78
	13	10.8 4.19 1.26	2.67 1.24	1 1 2	40.56	0.62	338.07 +0.14	244.6 0.0	0.85
	14	11.8 2.82 1.37	+1.33 1.34	1 1 2	52.71	0.64	338.97 0.90	245.9 +1.3	0.91
			1.43 1.40				1.65	3.2	
	15	12.8 +1.39	-0.07	+1 -1 +2	64.85	-0.67	340.62	249.1	0.96
	16	13.8 -0.03 -1.42	-1.46 -1.39	+1 -1 +2	76.99	-0.70	343.01 +2.39	256.2 +7.1	0.99

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	Age	The Earth's Selenographic		Physical Libration	The Sun's Selenographic		Position Angle of		Fraction Illuminated	
		Longitude	Latitude	Lg. Lt. P.A.	Colong.	Lat.	Axis	Bright Limb		
		^d	[°]	[°]	^(0°01)	[°]	[°]	[°]		
Nov.	16	13.8	-0.03	-1.46	+1 -1 +2	76.99	-0.70	343.01	256.2	0.99
	17	14.8	1.39	2.79	1 1 2	89.13	0.73	346.18	298.5	1.00
	18	15.8	2.67	4.00	1 1 2	101.27	0.75	350.10	59.6	0.99
	19	16.8	3.82	5.05	1 1 2	113.42	0.77	354.71	73.0	0.97
	20	17.8	4.82	5.88	+1 1 2	125.56	0.80	359.78	81.5	0.93
	21	18.8	-5.64	-6.46	0 -1 +2	137.70	-0.82	5.01	89.1	0.87
	22	19.8	6.26	6.73	0 1 2	149.85	0.84	10.01	96.1	0.79
	23	20.8	6.64	6.68	0 1 2	162.00	0.86	14.39	102.3	0.71
	24	21.8	6.76	6.29	0 1 2	174.16	0.88	17.91	107.4	0.61
	25	22.8	6.58	5.55	0 1 2	186.32	0.90	20.39	111.3	0.50
	26	23.8	-6.08	-4.48	0 -1 +2	198.49	-0.92	21.80	113.7	0.39
	27	24.8	5.23	3.13	+1 1 2	210.67	0.93	22.11	114.6	0.29
	28	25.8	4.05	-1.54	1 1 2	222.85	0.96	21.31	113.8	0.19
29	26.8	2.56	+0.18	1 1 2	235.04	0.98	19.34	110.7	0.10	
30	27.8	-0.83	1.91	1 1 2	247.23	1.00	16.14	104.3	0.04	
Dec.	1	28.8	+1.03	+3.52	+1 -1 +2	259.43	-1.02	11.68	87.2	0.01
	2	0.3	2.88	4.88	1 1 2	271.62	1.04	6.15	316.4	0.00
	3	1.3	4.57	5.89	1 1 2	283.82	1.07	359.99	284.0	0.03
	4	2.3	5.95	6.49	1 1 2	296.01	1.09	353.86	272.1	0.08
	5	3.3	6.92	6.67	1 1 2	308.20	1.11	348.43	263.5	0.15
	6	4.3	+7.42	+6.47	+1 -1 +2	320.38	-1.13	344.11	256.8	0.23
	7	5.3	7.43	5.92	1 1 2	332.56	1.16	341.00	251.9	0.33
	8	6.3	7.00	5.10	1 1 2	344.73	1.18	339.04	248.6	0.43
	9	7.3	6.19	4.05	1 1 2	356.90	1.20	338.07	246.7	0.52
	10	8.3	5.08	2.85	1 1 2	9.05	1.22	337.97	246.0	0.62
	11	9.3	+3.78	+1.54	+1 -1 +2	21.20	-1.24	338.65	246.6	0.71
	12	10.3	2.37	+0.17	+1 1 2	33.35	1.26	340.08	248.4	0.79
	13	11.3	+0.93	-1.20	0 1 2	45.49	1.28	342.25	251.7	0.86
	14	12.3	-0.46	2.52	0 1 2	57.63	1.30	345.20	256.7	0.92
	15	13.3	1.74	3.74	0 1 2	69.76	1.32	348.92	264.6	0.96
	16	14.3	-2.86	-4.80	0 -1 +2	81.89	-1.33	353.38	280.6	0.99
	17	15.3	3.79	5.66	0 1 2	94.02	1.35	358.39	1.6	1.00
	18	16.3	4.52	6.26	0 1 2	106.15	1.36	3.67	71.2	0.99
	19	17.3	5.05	6.57	0 1 2	118.28	1.37	8.81	87.1	0.96
	20	18.3	5.38	6.56	0 1 2	130.42	1.38	13.40	96.5	0.91
	21	19.3	-5.52	-6.21	0 -1 +2	142.55	-1.38	17.14	103.2	0.84
	22	20.3	5.47	5.53	0 1 2	154.69	1.39	19.86	108.2	0.75
	23	21.3	5.24	4.53	0 1 2	166.84	1.40	21.51	111.5	0.66
	24	22.3	4.80	3.27	0 1 2	178.99	1.40	22.11	113.2	0.55
	25	23.3	4.15	1.79	0 1 2	191.15	1.41	21.66	113.3	0.44
	26	24.3	-3.26	-0.18	0 -1 +2	203.31	-1.41	20.14	111.7	0.33
	27	25.3	2.13	+1.46	0 1 2	215.49	1.42	17.49	108.2	0.22
	28	26.3	-0.79	3.03	0 1 2	227.66	1.43	13.65	102.5	0.13
	29	27.3	+0.69	4.42	0 1 2	239.85	1.44	8.66	93.8	0.06
	30	28.3	2.23	5.50	0 1 2	252.03	1.45	2.80	78.9	0.02
	31	29.3	+3.69	+6.22	0 -1 +2	264.22	-1.46	356.60	20.3	0.00
	32	0.8	+4.93	+6.53	0 -1 +2	276.41	-1.47	350.77	284.4	0.01

MERCURY, 1967
ILLUMINATED DISK
FOR 0^h UNIVERSAL TIME

Date	k	i	Θ	L	Stellar Mag.	Date	k	i	Θ	L	Stellar Mag.			
		°	°					°	°					
Jan. 0	0.962	+ 17	23	87	25.5	-0.5	July 4	0.033	159	302	5.3	+2.6		
5	.979	12	17	79	24.9	0.6	9	.009	169	357	1.5	3.1		
10	.991	6	11	66	25.3	+ 0.4	14	.030	160	61	5.0	2.6		
15	.997	+ 1	6	36	26.9	1.6	19	.098	+ 68	143	77	15.0	+10.0	
20	.998	- 10	6	316	29.9	3.0	24	.207	109	126	85	28.3	13.3	
					4.9	1.0		143				14.2	1.2	
25	0.988	- 26	12	278	34.8	-1.0	29	0.350	+171	107	90	42.5	+13.7	+0.5
30	.962	58	23	265	42.2	+ 7.4	Aug. 3	.521	182	88	96	56.2	10.3	-0.1
Feb. 4	.904	107	36	257	52.4	10.2	8	.703	158	66	102	66.5	+ 2.4	0.7
9	.797	175	54	251	63.8	11.4	13	.861	98	44	110	68.9	- 6.4	1.1
14	.622	227	76	246	69.8	- 9.6	18	.959	+ 37	23	121	62.5	10.2	1.4
19	0.395	-220	102	242	60.2	+0.1	23	0.996	- 4	7	156	52.3	- 9.3	-1.5
24	.175	-140	130	236	33.5	-26.7	28	.992	32	10	265	43.0	6.8	1.3
Mar. 1	.035	99	158	218	7.5	-26.0	Sept. 2	.969	23	20	283	36.2	4.5	0.9
6	.013	85	167	114	2.7	...	7	.937	35	29	289	31.7	2.7	0.6
11	.086	+113	146	80	14.7	...	12	.902	38	37	292	29.0	1.3	0.4
					+11.8	1.9								
16	0.199	+114	127	73	26.5	+1.3	17	0.864	- 41	43	294	27.7	- 0.1	-0.2
21	.313	99	112	69	32.0	+ 5.5	22	.823	48	50	295	27.6	+ 1.0	0.0
26	.412	85	100	67	33.3	+ 1.3	27	.775	56	57	295	28.6	2.1	+0.1
31	.497	74	90	65	32.9	- 0.4	Oct. 2	.719	71	64	295	30.7	3.1	0.1
Apr. 5	.571	66	82	63	32.3	- 0.6	7	.648	93	73	295	33.8	3.8	0.2
					0.0	0.4								
10	0.637	+ 63	74	62	32.3	+0.3	12	0.555	-122	84	294	37.6	+ 2.8	+0.3
15	.700	63	66	61	33.2	+0.1	17	.433	157	98	294	40.4	- 3.3	0.5
20	.763	66	58	60	35.4	-0.1	22	.276	-171	117	295	37.1	-17.0	0.8
25	.829	67	49	60	39.3	0.4	27	.105	...	142	298	20.1	...	1.6
30	.896	62	38	61	45.3	0.8	Nov. 1	.002	...	175	316	0.5	...	3.0
					8.3									
May 5	0.958	+ 39	24	63	53.6	-1.3	6	0.074	+217	148	115	17.0	+33.2	+1.7
10	.997	- 11	6	67	62.5	+ 8.9	11	.291	234	115	117	50.2	+10.5	+0.5
15	.986	73	14	248	68.0	- 1.8	16	.525	176	87	116	60.7	- 6.3	-0.2
20	.913	115	34	253	66.2	7.4	21	.701	116	66	115	54.4	9.7	0.5
25	.798	125	53	258	58.8	8.6	26	.817	72	51	112	44.7	8.0	0.5
30	0.673	-119	70	262	50.2	-0.3	Dec. 1	0.889	+ 46	39	109	36.7	- 5.6	-0.6
June 4	.554	107	84	267	43.0	+0.1	6	.935	28	30	105	31.1	3.6	0.6
9	.447	98	96	271	37.3	0.5	11	.963	19	22	99	27.5	2.1	0.6
14	.349	92	108	275	32.4	5.1	16	.982	11	16	92	25.4	- 0.9	0.6
19	.257	87	119	279	27.3	6.3	21	.993	+ 5	10	80	24.5	+ 0.2	0.7
24	0.170	- 78	131	283	21.0	+1.5	26	0.998	0	5	49	24.7	+ 1.4	-0.8
29	.092	- 59	145	289	13.1	- 7.9	31	.998	- 6	5	322	26.1	+ 2.7	0.8
July 4	0.033		159	302	5.3	- 7.8	36	0.992		10	288	28.8		-0.8

ILLUMINATED DISK
FOR 0^h UNIVERSAL TIME

Date	<i>k</i>	<i>i</i>	θ	<i>L</i>	Stellar Mag.	Date	<i>k</i>	<i>i</i>	θ	<i>L</i>	Stellar Mag.
		°	°					°	°		
Jan. 0	0.978	17.2	266.2	47.6	-3.4	July 4	0.416	99.7	289.1	155.0	-4.1
5	.973	18.8	263.8	48.0	3.4	9	.382	103.6	290.4	163.1	4.1
10	.968	20.5	261.5	48.5	3.3	14	.346	107.9	291.7	170.4	4.1
15	.963	22.1	259.3	49.1	3.3	19	.309	112.5	293.0	176.1	4.2
20	.958	23.8	257.3	49.7	3.3	24	.268	117.6	294.5	178.7	4.2
25	0.951	25.5	255.5	50.3	-3.3	29	0.225	123.3	296.2	176.2	-4.2
30	.945	27.2	253.8	51.1	3.3	Aug. 3	.181	129.6	298.3	166.1	4.1
Feb. 4	.938	28.9	252.4	51.9	3.3	8	.136	136.7	301.3	146.1	4.1
9	.930	30.6	251.1	52.7	3.3	13	.093	144.5	305.7	115.2	3.9
14	.922	32.3	250.1	53.7	3.3	18	.055	153.0	313.1	76.8	3.7
19	0.914	34.1	249.4	54.7	-3.3	23	0.026	161.4	327.7	40.1	-3.4
24	.905	35.9	248.8	55.8	3.4	28	.012	167.6	1.6	18.9	3.2
Mar. 1	.895	37.8	248.5	57.0	3.4	Sept. 2	.014	166.3	50.8	23.2	3.3
6	.885	39.6	248.4	58.3	3.4	7	.033	158.9	77.2	51.5	3.6
11	.874	41.5	248.6	59.7	3.4	12	.066	150.3	88.8	92.4	3.8
16	0.863	43.5	248.9	61.2	-3.4	17	0.106	141.9	95.2	132.5	-4.0
21	.851	45.4	249.6	62.8	3.4	22	.151	134.2	99.3	163.5	4.2
26	.838	47.5	250.4	64.5	3.4	27	.197	127.4	102.3	182.9	4.2
31	.825	49.5	251.5	66.4	3.4	Oct. 2	.241	121.2	104.7	192.3	4.3
Apr. 5	.811	51.6	252.8	68.4	3.5	7	.283	115.7	106.7	194.2	4.3
10	0.796	53.7	254.4	70.6	-3.5	12	0.323	110.8	108.4	191.1	-4.3
15	.780	55.9	256.1	72.9	3.5	17	.360	106.3	109.9	185.0	4.2
20	.764	58.1	258.1	75.5	3.5	22	.394	102.2	111.2	177.2	4.2
25	.747	60.4	260.2	78.3	3.5	27	.427	98.4	112.3	168.7	4.2
30	.730	62.7	262.4	81.3	3.6	Nov. 1	.457	94.9	113.2	160.0	4.1
May 5	0.711	65.0	264.8	84.5	-3.6	6	0.486	91.6	113.9	151.5	-4.1
10	.692	67.4	267.2	88.1	3.6	11	.513	88.5	114.4	143.4	4.0
15	.672	69.9	269.6	92.0	3.6	16	.539	85.6	114.6	135.7	4.0
20	.651	72.4	272.1	96.3	3.7	21	.563	82.8	114.6	128.5	3.9
25	.629	75.0	274.4	100.9	3.7	26	.586	80.1	114.3	121.9	3.9
30	0.607	77.7	276.7	106.0	-3.7	Dec. 1	0.608	77.5	113.8	115.7	-3.8
June 4	.583	80.4	278.9	111.5	3.8	6	.629	75.0	113.1	110.0	3.8
9	.558	83.3	280.9	117.5	3.8	11	.650	72.6	112.0	104.8	3.8
14	.533	86.3	282.8	124.1	3.9	16	.669	70.3	110.8	99.9	3.7
19	.506	89.4	284.6	131.2	3.9	21	.687	68.0	109.3	95.4	3.7
24	0.477	92.6	286.2	138.8	-4.0	26	0.705	65.8	107.5	91.3	-3.7
29	.447	96.1	287.7	146.8	4.0	31	.722	63.6	105.5	87.4	3.6
July 4	0.416	99.7	289.1	155.0	-4.1	36	0.738	61.5	103.3	83.9	-3.6

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	Light-time	Stellar Magnitude	Diameter	A_E+180°	D_E	A_S-A_E	D_S	L_S
	m		"	°	°	°	°	°
Jan. 0	11.88	+1.1	6.55	286.45	+22.14	-39.03	+22.33	69.20
2	11.71	1.1	6.64	287.45	21.98	39.09	22.47	70.07
4	11.54	1.1	6.74	288.43	21.82	39.14	22.60	70.94
6	11.38	1.0	6.84	289.39	21.66	39.16	22.72	71.82
8	11.21	1.0	6.94	290.34	21.50	39.17	22.84	72.69
10	11.04	+1.0	7.04	291.26	+21.33	-39.16	+22.95	73.56
12	10.87	0.9	7.15	292.17	21.16	39.12	23.06	74.44
14	10.71	0.9	7.27	293.06	20.98	39.07	23.16	75.31
16	10.54	0.9	7.38	293.93	20.81	38.99	23.25	76.19
18	10.37	0.8	7.50	294.77	20.63	38.89	23.34	77.06
20	10.20	+0.8	7.62	295.60	+20.45	-38.76	+23.42	77.94
22	10.03	0.7	7.75	296.41	20.27	38.62	23.50	78.82
24	9.87	0.7	7.88	297.19	20.09	38.45	23.58	79.69
26	9.70	0.7	8.02	297.95	19.92	38.25	23.64	80.57
28	9.53	0.6	8.16	298.68	19.74	38.03	23.70	81.45
30	9.37	+0.6	8.30	299.39	+19.57	-37.78	+23.76	82.33
Feb. 1	9.20	0.5	8.45	300.08	19.39	37.51	23.81	83.21
3	9.04	0.5	8.60	300.73	19.23	37.20	23.85	84.09
5	8.88	0.5	8.76	301.36	19.06	36.87	23.89	84.97
7	8.72	0.4	8.92	301.96	18.90	36.50	23.92	85.85
9	8.55	+0.4	9.09	302.53	+18.75	-36.11	+23.94	86.73
11	8.40	0.3	9.26	303.07	18.60	35.68	23.96	87.62
13	8.24	0.3	9.44	303.57	18.46	35.21	23.98	88.50
15	8.08	0.2	9.62	304.04	18.32	34.72	23.98	89.39
17	7.93	0.2	9.81	304.48	18.19	34.18	23.99	90.27
19	7.77	+0.1	10.01	304.88	+18.08	-33.61	+23.98	91.16
21	7.62	+0.1	10.20	305.24	17.97	33.00	23.97	92.05
23	7.47	0.0	10.41	305.57	17.87	32.35	23.95	92.94
25	7.33	0.0	10.61	305.85	17.78	31.66	23.93	93.83
27	7.19	-0.1	10.82	306.10	17.70	30.93	23.90	94.73
Mar. 1	7.04	-0.1	11.04	306.30	+17.64	-30.15	+23.86	95.62
3	6.91	0.2	11.26	306.46	17.59	29.33	23.82	96.52
5	6.77	0.3	11.49	306.57	17.55	28.47	23.77	97.41
7	6.64	0.3	11.71	306.64	17.53	27.55	23.72	98.31
9	6.51	0.4	11.94	306.65	17.52	26.59	23.66	99.21
11	6.39	-0.4	12.18	306.62	+17.53	-25.58	+23.59	100.11
13	6.27	0.5	12.41	306.54	17.55	24.51	23.52	101.01
15	6.15	0.6	12.65	306.41	17.59	23.40	23.44	101.92
17	6.04	0.6	12.88	306.22	17.65	22.23	23.35	102.83
19	5.93	0.7	13.11	305.99	17.72	21.01	23.26	103.73
21	5.83	-0.7	13.34	305.70	+17.81	-19.74	+23.16	104.64
23	5.73	0.8	13.57	305.37	17.91	18.42	23.06	105.55
25	5.64	0.8	13.79	304.98	18.03	17.05	22.94	106.47
27	5.55	0.9	14.01	304.54	18.17	15.63	22.83	107.38
29	5.47	0.9	14.22	304.06	18.32	14.16	22.70	108.30
31	5.40	-1.0	14.42	303.53	+18.49	-12.64	+22.57	109.22
Apr. 2	5.33	-1.1	14.60	302.95	+18.66	-11.08	+22.44	110.14

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	<i>k</i>	<i>i</i>	Defect of Illumination	Position Angle of		Central Meridian		Universal Time of Transit of Zero Meridian	
				Defect	Axis	Of Date	Of Following Date	Of Date	Of Following Date
		°	"	°	°	°	°	h m	h m
Jan. 0	0.904	36.03	0.63	292.96	30.91	13.14	3.56	23 45.4	.. . .
2	.904	36.09	0.64	292.83	31.22	353.97	344.39	0 24.8	1 04.1
4	.904	36.14	0.65	292.70	31.53	334.82	325.25	1 43.5	2 22.8
6	.904	36.17	0.66	292.56	31.82	315.68	306.12	3 02.1	3 41.4
8	.904	36.20	0.67	292.42	32.10	296.56	287.01	4 20.7	4 59.9
10	0.903	36.20	0.68	292.27	32.37	277.46	267.92	5 39.2	6 18.4
12	.904	36.19	0.69	292.12	32.62	258.38	248.84	6 57.6	7 36.7
14	.904	36.16	0.70	291.97	32.86	239.31	229.79	8 15.9	8 55.0
16	.904	36.12	0.71	291.81	33.09	220.27	210.76	9 34.1	10 13.2
18	.904	36.06	0.72	291.64	33.31	201.25	191.74	10 52.2	11 31.3
20	0.905	35.98	0.73	291.48	33.52	182.24	172.75	12 10.3	12 49.3
22	.905	35.87	0.74	291.31	33.71	163.26	153.78	13 28.2	14 07.2
24	.906	35.75	0.74	291.14	33.89	144.31	134.84	14 46.1	15 25.0
26	.906	35.61	0.75	290.96	34.06	125.37	115.91	16 03.8	16 42.7
28	.907	35.45	0.76	290.79	34.22	106.46	97.02	17 21.5	18 00.3
30	0.908	35.26	0.76	290.61	34.37	87.58	78.14	18 39.0	19 17.7
Feb. 1	.909	35.05	0.77	290.43	34.51	68.72	59.30	19 56.4	20 35.1
3	.911	34.81	0.77	290.25	34.64	49.88	40.48	21 13.7	21 52.4
5	.912	34.55	0.77	290.07	34.76	31.08	21.69	22 30.9	23 09.5
7	.913	34.26	0.77	289.89	34.87	12.30	2.92	23 48.0	.. . .
9	0.915	33.94	0.77	289.71	34.98	353.56	344.19	0 26.5	1 04.9
11	.917	33.58	0.77	289.53	35.07	334.84	325.50	1 43.3	2 21.7
13	.918	33.20	0.77	289.34	35.15	316.16	306.83	3 00.0	3 38.3
15	.920	32.78	0.77	289.16	35.23	297.51	288.20	4 16.6	4 54.8
17	.922	32.33	0.76	288.99	35.30	278.89	269.60	5 33.0	6 11.2
19	0.925	31.84	0.75	288.81	35.36	260.32	251.04	6 49.3	7 27.4
21	.927	31.32	0.74	288.63	35.41	241.77	232.52	8 05.4	8 43.4
23	.930	30.75	0.73	288.46	35.46	223.27	214.03	9 21.3	9 59.2
25	.932	30.15	0.72	288.28	35.50	204.80	195.58	10 37.1	11 14.9
27	.935	29.50	0.70	288.11	35.53	186.38	177.18	11 52.7	12 30.4
Mar. 1	0.938	28.82	0.68	287.94	35.56	167.99	158.82	13 08.1	13 45.8
3	.941	28.08	0.66	287.76	35.58	149.65	140.50	14 23.3	15 00.9
5	.944	27.30	0.64	287.59	35.59	131.36	122.23	15 38.4	16 15.8
7	.948	26.47	0.61	287.42	35.60	113.11	104.00	16 53.2	17 30.5
9	.951	25.59	0.59	287.24	35.60	94.91	85.82	18 07.8	18 45.1
11	0.954	24.66	0.56	287.06	35.60	76.75	67.69	19 22.2	19 59.4
13	.958	23.68	0.52	286.87	35.59	58.65	49.61	20 36.4	21 13.5
15	.961	22.65	0.49	286.68	35.57	40.59	31.58	21 50.4	22 27.3
17	.965	21.56	0.45	286.47	35.55	22.59	13.60	23 04.2	23 41.0
19	.969	20.42	0.41	286.24	35.51	4.63	355.67	.. . .	0 17.7
21	0.972	19.23	0.37	285.99	35.47	346.73	337.79	0 54.4	1 31.1
23	.976	17.99	0.33	285.71	35.43	328.87	319.96	2 07.7	2 44.2
25	.979	16.70	0.29	285.39	35.37	311.06	302.18	3 20.7	3 57.1
27	.982	15.35	0.25	285.00	35.31	293.31	284.44	4 33.5	5 09.8
29	.985	13.96	0.21	284.54	35.23	275.59	266.75	5 46.1	6 22.4
31	0.988	12.52	0.17	283.95	35.15	257.93	249.11	6 58.6	7 34.7
Apr. 2	0.991	11.04	0.14	283.18	35.05	240.30	231.50	8 10.8	8 46.8

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	Light-time	Stellar Magnitude	Diameter	A_E+180°	D_E	A_S-A_E	D_S	L_S
	m		"	°	°	°	°	°
Apr. 2	5.33	-1.1	14.60	302.95	+18.66	-11.08	+22.44	110.14
4	5.26	1.1	14.78	302.34	18.85	9.48	22.29	111.06
6	5.21	1.2	14.94	301.69	19.06	7.84	22.14	111.99
8	5.16	1.2	15.09	301.00	19.27	6.17	21.99	112.92
10	5.11	1.2	15.21	300.28	19.49	4.47	21.83	113.84
12	5.08	-1.3	15.32	299.54	+19.71	- 2.74	+21.66	114.78
14	5.05	1.3	15.41	298.79	19.94	- 1.00	21.49	115.71
16	5.02	1.3	15.48	298.02	20.17	+ 0.76	21.31	116.65
18	5.01	1.3	15.53	297.24	20.41	2.52	21.12	117.58
20	5.00	1.3	15.56	296.46	20.64	4.28	20.93	118.52
22	5.00	-1.3	15.57	295.70	+20.87	+ 6.04	+20.73	119.47
24	5.00	1.3	15.56	294.94	21.10	7.78	20.52	120.41
26	5.01	1.2	15.52	294.20	21.32	9.51	20.31	121.36
28	5.03	1.2	15.47	293.48	21.54	11.21	20.09	122.31
30	5.05	1.2	15.40	292.80	21.75	12.88	19.87	123.27
May 2	5.08	-1.2	15.31	292.14	+21.95	+14.52	+19.64	124.22
4	5.11	1.1	15.21	291.53	22.14	16.12	19.41	125.18
6	5.16	1.1	15.09	290.96	22.33	17.68	19.17	126.14
8	5.20	1.0	14.95	290.43	22.50	19.19	18.92	127.10
10	5.25	1.0	14.81	289.96	22.66	20.65	18.66	128.07
12	5.31	-1.0	14.65	289.53	+22.82	+22.06	+18.41	129.04
14	5.37	0.9	14.49	289.17	22.96	23.41	18.14	130.01
16	5.43	0.9	14.31	288.85	23.09	24.71	17.87	130.99
18	5.50	0.8	14.14	288.60	23.22	25.95	17.59	131.97
20	5.57	0.8	13.95	288.40	23.33	27.13	17.31	132.95
22	5.65	-0.8	13.76	288.26	+23.43	+28.25	+17.02	133.93
24	5.73	0.7	13.57	288.18	23.53	29.32	16.73	134.92
26	5.81	0.7	13.38	288.15	23.61	30.33	16.43	135.91
28	5.90	0.6	13.19	288.18	23.68	31.29	16.13	136.90
30	5.98	0.6	13.00	288.27	23.74	32.19	15.82	137.90
June 1	6.07	-0.5	12.81	288.41	+23.80	+33.04	+15.50	138.90
3	6.17	0.5	12.62	288.60	23.84	33.83	15.18	139.90
5	6.26	0.5	12.43	288.84	23.87	34.57	14.85	140.90
7	6.36	0.4	12.24	289.13	23.90	35.27	14.52	141.91
9	6.45	0.4	12.05	289.47	23.91	35.92	14.19	142.93
11	6.55	-0.3	11.87	289.85	+23.92	+36.51	+13.84	143.94
13	6.65	0.3	11.69	290.29	23.91	37.07	13.50	144.96
15	6.75	0.3	11.52	290.76	23.89	37.58	13.15	145.98
17	6.85	0.2	11.35	291.28	23.87	38.05	12.79	147.01
19	6.96	0.2	11.18	291.84	23.83	38.48	12.43	148.04
21	7.06	-0.2	11.01	292.43	+23.79	+38.87	+12.06	149.07
23	7.17	0.1	10.85	293.06	23.73	39.23	11.69	150.11
25	7.27	0.1	10.70	293.73	23.66	39.55	11.31	151.15
27	7.38	-0.1	10.55	294.43	23.58	39.84	10.93	152.19
29	7.48	0.0	10.40	295.16	23.50	40.10	10.55	153.24
July 1	7.59	0.0	10.25	295.92	+23.40	+40.33	+10.16	154.29
3	7.69	0.0	10.11	296.71	+23.28	+40.54	+ 9.76	155.34

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^b UNIVERSAL TIME

Date	<i>k</i>	<i>i</i>	Defect of Illumination	Position Angle of		Central Meridian		Universal Time of Transit of Zero Meridian	
				Defect	Axis	Of Date	Of Following Date	Of Date	Of Following Date
		°	"	°	°	°	°	h m	h m
Apr. 2	0.991	11.04	0.14	283.18	35.05	240.30	231.50	8 10.8	8 46.8
4	.993	9.52	0.10	282.14	34.95	222.72	213.94	9 22.9	9 58.8
6	.995	7.96	0.07	280.66	34.83	205.17	196.40	10 34.8	11 10.7
8	.997	6.38	0.05	278.40	34.70	187.65	178.90	11 46.6	12 22.4
10	.998	4.79	0.03	274.53	34.57	170.16	161.42	12 58.2	13 34.0
12	0.999	3.22	0.01	266.71	34.42	152.69	143.97	14 09.8	14 45.6
14	1.000	1.80	0.00	245.20	34.26	135.24	126.52	15 21.4	15 57.1
16	1.000	1.34	0.00	182.12	34.10	117.80	109.08	16 32.8	17 08.6
18	1.000	2.46	0.01	141.17	33.93	100.36	91.65	17 44.3	18 20.1
20	0.999	4.02	0.02	128.60	33.75	82.93	74.20	18 55.8	19 31.6
22	0.998	5.65	0.04	123.19	33.57	65.48	56.75	20 07.4	20 43.1
24	.996	7.30	0.06	120.25	33.38	48.02	39.28	21 19.0	21 54.8
26	.994	8.94	0.09	118.43	33.20	30.54	21.79	22 30.7	23 06.6
28	.992	10.57	0.13	117.20	33.01	13.03	4.27	23 42.5	.. ..
30	.989	12.18	0.17	116.32	32.83	355.50	346.72	0 18.5	0 54.5
May 2	0.986	13.76	0.22	115.66	32.66	337.93	329.13	1 30.5	2 06.6
4	.982	15.31	0.27	115.15	32.49	320.32	311.50	2 42.7	3 18.9
6	.979	16.82	0.32	114.75	32.33	302.67	293.82	3 55.1	4 31.4
8	.975	18.29	0.38	114.43	32.18	284.96	276.09	5 07.7	5 44.1
10	.971	19.71	0.43	114.16	32.04	267.21	258.31	6 20.6	6 57.1
12	0.967	21.09	0.49	113.94	31.92	249.40	240.48	7 33.6	8 10.3
14	.962	22.42	0.55	113.75	31.81	231.54	222.59	8 46.9	9 23.7
16	.958	23.70	0.60	113.59	31.72	213.62	204.64	10 00.5	10 37.4
18	.953	24.92	0.66	113.45	31.65	195.64	186.63	11 14.3	11 51.3
20	.949	26.10	0.71	113.32	31.59	177.61	168.57	12 28.4	13 05.5
22	0.945	27.22	0.76	113.21	31.55	159.51	150.44	13 42.7	14 19.9
24	.940	28.30	0.81	113.12	31.53	141.36	132.26	14 57.2	15 34.6
26	.936	29.32	0.86	113.03	31.52	123.15	114.02	16 12.1	16 49.5
28	.932	30.30	0.90	112.95	31.53	104.88	95.73	17 27.1	18 04.7
30	.928	31.23	0.94	112.87	31.57	86.56	77.38	18 42.4	19 20.1
June 1	0.923	32.11	0.98	112.80	31.61	68.19	58.98	19 57.9	20 35.7
3	.920	32.95	1.01	112.74	31.68	49.76	40.52	21 13.6	21 51.6
5	.916	33.74	1.05	112.67	31.76	31.28	22.02	22 29.6	23 07.7
7	.912	34.49	1.08	112.61	31.85	12.75	3.46	23 45.8	.. ..
9	.909	35.20	1.10	112.55	31.96	354.17	344.86	0 24.0	1 02.2
11	0.905	35.87	1.13	112.49	32.08	335.54	326.21	1 40.4	2 18.8
13	.902	36.50	1.15	112.43	32.22	316.87	307.52	2 57.1	3 35.5
15	.899	37.09	1.17	112.37	32.36	298.15	288.78	4 14.0	4 52.5
17	.896	37.64	1.18	112.31	32.52	279.39	270.00	5 31.1	6 09.7
19	.893	38.16	1.19	112.24	32.69	260.59	251.18	6 48.3	7 27.0
21	0.890	38.65	1.21	112.17	32.86	241.76	232.33	8 05.7	8 44.4
23	.888	39.11	1.22	112.10	33.05	222.89	213.44	9 23.2	10 02.1
25	.886	39.54	1.22	112.02	33.23	203.98	194.51	10 40.9	11 19.8
27	.883	39.94	1.23	111.94	33.43	185.04	175.55	11 58.8	12 37.8
29	.881	40.31	1.23	111.86	33.63	166.06	156.57	13 16.8	13 55.8
July 1	0.879	40.65	1.24	111.77	33.83	147.06	137.55	14 34.9	15 14.0
3	0.878	40.97	1.24	111.68	34.03	128.03	118.50	15 53.1	16 32.3

EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h UNIVERSAL TIME

Date	Light-time	Stellar Magnitude	Diameter	A_E+180°	D_E	A_S-A_E	D_S	L_S	
	m		"	°	°	°	°	°	
July	1	7.59	0.0	10.25	295.92	+23.40	+40.33	+10.16	154.29
	3	7.69	0.0	10.11	296.71	23.28	40.54	9.76	155.34
	5	7.80	+0.1	9.97	297.53	23.16	40.71	9.37	156.40
	7	7.91	0.1	9.84	298.37	23.03	40.86	8.96	157.46
	9	8.01	0.1	9.71	299.24	22.88	40.99	8.56	158.53
	11	8.12	+0.2	9.58	300.14	+22.73	+41.09	+ 8.15	159.60
	13	8.22	0.2	9.46	301.06	22.56	41.17	7.73	160.67
	15	8.33	0.2	9.34	302.00	22.38	41.24	7.32	161.75
	17	8.44	0.2	9.22	302.95	22.19	41.28	6.89	162.83
	19	8.54	0.3	9.11	303.93	21.98	41.30	6.47	163.91
	21	8.65	+0.3	9.00	304.93	+21.77	+41.31	+ 6.04	165.00
	23	8.75	0.3	8.89	305.94	21.54	41.31	5.61	166.09
	25	8.86	0.3	8.78	306.97	21.30	41.29	5.17	167.19
	27	8.96	0.4	8.68	308.02	21.05	41.25	4.73	168.28
	29	9.06	0.4	8.58	309.08	20.78	41.21	4.29	169.39
	Aug.	31	9.17	+0.4	8.49	310.15	+20.51	+41.15	+ 3.85	170.49
2		9.27	0.4	8.39	311.24	20.22	41.09	3.40	171.61
4		9.37	0.4	8.30	312.33	19.92	41.01	2.95	172.72
6		9.47	0.5	8.21	313.44	19.61	40.92	2.50	173.84
8		9.57	0.5	8.12	314.56	19.28	40.83	2.05	174.96
10		9.68	+0.5	8.04	315.70	+18.95	+40.73	+ 1.59	176.09
12		9.78	0.5	7.96	316.84	18.60	40.62	1.13	177.22
14		9.88	0.5	7.88	317.99	18.24	40.50	0.67	178.35
16		9.97	0.6	7.80	319.15	17.87	40.38	+ 0.21	179.49
18		10.07	0.6	7.72	320.31	17.48	40.26	- 0.25	180.63
20		10.17	+0.6	7.65	321.49	+17.09	+40.13	- 0.72	181.77
22		10.27	0.6	7.57	322.67	16.68	40.00	1.19	182.92
24		10.37	0.6	7.50	323.85	16.27	39.87	1.65	184.07
26		10.46	0.6	7.43	325.05	15.84	39.73	2.12	185.23
28		10.56	0.7	7.37	326.24	15.40	39.60	2.59	186.39
Sept.		30	10.65	+0.7	7.30	327.45	+14.95	+39.46	- 3.06
	1	10.75	0.7	7.24	328.66	14.49	39.32	3.53	188.72
	3	10.84	0.7	7.17	329.87	14.02	39.18	4.00	189.89
	5	10.94	0.7	7.11	331.09	13.54	39.03	4.47	191.06
	7	11.03	0.7	7.05	332.32	13.05	38.89	4.94	192.24
	9	11.12	+0.7	6.99	333.55	+12.55	+38.75	- 5.41	193.42
	11	11.21	0.8	6.94	334.78	12.04	38.61	5.88	194.61
	13	11.31	0.8	6.88	336.02	11.52	38.47	6.35	195.80
	15	11.40	0.8	6.83	337.26	11.00	38.33	6.82	196.99
	17	11.49	0.8	6.77	338.51	10.46	38.20	7.29	198.18
	19	11.58	+0.8	6.72	339.76	+ 9.92	+38.06	- 7.75	199.38
	21	11.67	0.8	6.67	341.01	9.37	37.93	8.22	200.58
	23	11.76	0.8	6.62	342.27	8.81	37.80	8.68	201.79
	25	11.84	0.8	6.57	343.52	8.24	37.67	9.14	202.99
	27	11.93	0.9	6.52	344.79	7.67	37.54	9.59	204.21
	Oct.	29	12.02	+0.9	6.47	346.06	+ 7.09	+37.42	-10.05	205.42
1		12.11	+0.9	6.42	347.33	+ 6.51	+37.29	-10.50	206.64

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	<i>k</i>	<i>i</i>	Defect of Illumination	Position Angle of		Central Meridian		Universal Time of Transit of Zero Meridian	
				Defect	Axis	Of Date	Of Following Date	Of Date	Of Following Date
		°	"	°	°	°	°	h m	h m
July 1	0.879	40.65	1.24	111.77	33.83	147.06	137.55	14 34.9	15 14.0
3	.878	40.97	1.24	111.68	34.03	128.03	118.50	15 53.1	16 32.3
5	.876	41.27	1.24	111.58	34.23	108.97	99.43	17 11.5	17 50.7
7	.874	41.54	1.24	111.47	34.44	89.88	80.33	18 29.9	19 09.2
9	.873	41.79	1.24	111.36	34.64	70.77	61.20	19 48.5	20 27.8
11	0.871	42.02	1.23	111.24	34.84	51.63	42.06	21 07.2	21 46.6
13	.870	42.23	1.23	111.11	35.04	32.47	22.88	22 26.0	23 05.4
15	.869	42.42	1.22	110.97	35.24	13.29	3.69	23 44.8	.. . .
17	.868	42.59	1.22	110.83	35.43	354.09	344.48	0 24.3	1 03.8
19	.867	42.75	1.21	110.68	35.61	334.87	325.25	1 43.3	2 22.8
21	0.866	42.89	1.20	110.52	35.79	315.63	306.01	3 02.3	3 41.9
23	.866	43.01	1.19	110.35	35.96	296.38	286.74	4 21.5	5 01.1
25	.865	43.12	1.19	110.17	36.12	277.11	267.46	5 40.7	6 20.3
27	.864	43.21	1.18	109.98	36.27	257.82	248.17	6 60.0	7 39.6
29	.864	43.29	1.17	109.78	36.41	238.52	228.86	8 19.3	8 59.0
31	0.864	43.35	1.16	109.58	36.54	219.21	209.54	9 38.7	10 18.4
Aug. 2	.863	43.40	1.15	109.36	36.66	199.88	190.21	10 58.2	11 37.9
4	.863	43.44	1.14	109.13	36.77	180.54	170.87	12 17.7	12 57.4
6	.863	43.47	1.13	108.89	36.86	161.19	151.51	13 37.2	14 17.0
8	.863	43.48	1.11	108.64	36.94	141.83	132.14	14 56.8	15 36.6
10	0.863	43.49	1.10	108.38	37.00	122.45	112.76	16 16.5	16 56.3
12	.863	43.48	1.09	108.11	37.05	103.07	93.38	17 36.2	18 16.0
14	.863	43.47	1.08	107.83	37.08	83.68	73.98	18 55.9	19 35.7
16	.863	43.44	1.07	107.53	37.09	64.28	54.58	20 15.6	20 55.5
18	.863	43.40	1.06	107.23	37.09	44.88	35.17	21 35.4	22 15.3
20	0.864	43.36	1.04	106.91	37.07	25.46	15.75	22 55.2	23 35.2
22	.864	43.31	1.03	106.58	37.03	6.04	356.33	.. . .	0 15.1
24	.864	43.25	1.02	106.24	36.98	346.62	336.90	0 55.0	1 35.0
26	.865	43.18	1.01	105.89	36.90	327.18	317.47	2 14.9	2 54.9
28	.865	43.10	0.99	105.52	36.80	307.75	298.02	3 34.8	4 14.8
30	0.866	43.02	0.98	105.14	36.69	288.30	278.58	4 54.8	5 34.7
Sept. 1	.866	42.93	0.97	104.75	36.55	268.85	259.13	6 14.7	6 54.7
3	.867	42.83	0.96	104.35	36.39	249.40	239.67	7 34.7	8 14.7
5	.867	42.73	0.94	103.94	36.21	229.94	220.21	8 54.7	9 34.7
7	.868	42.61	0.93	103.51	36.01	210.48	200.74	10 14.7	10 54.7
9	0.869	42.49	0.92	103.07	35.79	191.01	181.27	11 34.8	12 14.8
11	.869	42.37	0.91	102.62	35.54	171.54	161.80	12 54.8	13 34.9
13	.870	42.24	0.89	102.16	35.27	152.06	142.32	14 14.9	14 54.9
15	.871	42.10	0.88	101.69	34.99	132.58	122.84	15 35.0	16 15.0
17	.872	41.96	0.87	101.21	34.68	113.10	103.35	16 55.1	17 35.1
19	0.873	41.82	0.86	100.71	34.34	93.61	83.86	18 15.2	18 55.3
21	.874	41.67	0.84	100.21	33.99	74.12	64.37	19 35.3	20 15.4
23	.874	41.51	0.83	99.69	33.61	54.62	44.88	20 55.5	21 35.6
25	.875	41.35	0.82	99.16	33.21	35.13	25.38	22 15.7	22 55.8
27	.876	41.18	0.81	98.62	32.79	15.63	5.87	23 35.8	.. . .
29	0.877	41.01	0.79	98.08	32.34	356.12	346.37	0 15.9	0 56.0
Oct. 1	0.878	40.84	0.78	97.52	31.88	336.61	326.86	1 36.2	2 16.3

EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h UNIVERSAL TIME

Date		Light-time	Stellar Magnitude	Diameter	A_E+180°	D_E	A_S-A_E	D_S	L_S
		m		"	°	°	°	°	°
Oct.	1	12.11	+0.9	6.42	347.33	+ 6.51	+37.29	-10.50	206.64
	3	12.20	0.9	6.38	348.60	5.91	37.17	10.95	207.86
	5	12.28	0.9	6.33	349.88	5.32	37.05	11.40	209.08
	7	12.37	0.9	6.29	351.16	4.71	36.94	11.84	210.31
	9	12.45	0.9	6.24	352.45	4.11	36.82	12.28	211.53
	11	12.54	+0.9	6.20	353.74	+ 3.49	+36.71	-12.71	212.77
	13	12.63	0.9	6.16	355.04	2.88	36.60	13.14	214.00
	15	12.71	0.9	6.12	356.34	2.25	36.50	13.56	215.24
	17	12.80	1.0	6.08	357.64	1.63	36.39	13.98	216.47
	19	12.88	1.0	6.04	358.95	1.00	36.29	14.40	217.71
	21	12.96	+1.0	6.00	0.27	+ 0.37	+36.19	-14.81	218.96
	23	13.05	1.0	5.96	1.59	- 0.26	36.09	15.21	220.20
	25	13.13	1.0	5.92	2.91	0.89	35.99	15.61	221.45
	27	13.22	1.0	5.89	4.24	1.53	35.90	16.00	222.70
	29	13.30	1.0	5.85	5.57	2.16	35.80	16.39	223.95
	31	13.38	+1.0	5.81	6.91	- 2.80	+35.71	-16.77	225.21
Nov.	2	13.47	1.0	5.78	8.26	3.43	35.61	17.14	226.46
	4	13.55	1.0	5.74	9.62	4.07	35.52	17.50	227.72
	6	13.63	1.0	5.71	10.98	4.71	35.43	17.86	228.98
	8	13.71	1.0	5.67	12.34	5.34	35.33	18.21	230.24
	10	13.80	+1.1	5.64	13.72	- 5.97	+35.24	-18.55	231.50
	12	13.88	1.1	5.60	15.10	6.60	35.14	18.88	232.76
	14	13.96	1.1	5.57	16.48	7.23	35.05	19.21	234.02
	16	14.04	1.1	5.54	17.88	7.85	34.95	19.52	235.29
	18	14.13	1.1	5.51	19.28	8.47	34.85	19.83	236.55
	20	14.21	+1.1	5.47	20.69	- 9.09	+34.75	-20.13	237.82
	22	14.29	1.1	5.44	22.11	9.70	34.65	20.41	239.09
	24	14.37	1.1	5.41	23.54	10.31	34.55	20.69	240.36
	26	14.45	1.1	5.38	24.97	10.91	34.44	20.96	241.63
	28	14.54	1.1	5.35	26.42	11.50	34.33	21.22	242.89
	30	14.62	+1.1	5.32	27.87	-12.09	+34.21	-21.46	244.16
Dec.	2	14.70	1.1	5.29	29.33	12.67	34.09	21.70	245.43
	4	14.78	1.2	5.26	30.80	13.24	33.96	21.92	246.70
	6	14.87	1.2	5.23	32.28	13.81	33.83	22.14	247.97
	8	14.95	1.2	5.20	33.77	14.36	33.70	22.34	249.24
	10	15.03	+1.2	5.18	35.27	-14.91	+33.56	-22.53	250.51
	12	15.11	1.2	5.15	36.78	15.45	33.41	22.71	251.78
	14	15.19	1.2	5.12	38.29	15.97	33.26	22.88	253.05
	16	15.27	1.2	5.09	39.82	16.49	33.10	23.04	254.32
	18	15.36	1.2	5.06	41.36	16.99	32.93	23.19	255.59
	20	15.44	+1.2	5.04	42.90	-17.48	+32.76	-23.32	256.85
	22	15.52	1.2	5.01	44.46	17.96	32.58	23.44	258.12
	24	15.60	1.2	4.98	46.02	18.43	32.39	23.55	259.38
	26	15.69	1.2	4.96	47.60	18.89	32.19	23.65	260.65
	28	15.77	1.2	4.93	49.18	19.33	31.98	23.73	261.91
	30	15.85	+1.3	4.91	50.77	-19.75	+31.76	-23.81	263.17
	32	15.93	+1.3	4.88	52.37	-20.17	+31.54	-23.87	264.43

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	<i>k</i>	<i>i</i>	Defect of Illumination	Position Angle of		Central Meridian		Universal Time of Transit of Zero Meridian	
				Defect	Axis	Of Date	Of Following Date	Of Date	Of Following Date
		°	"	°	°	°	°	h m	h m
Oct. 1	0.878	40.84	0.78	97.52	31.88	336.61	326.86	1 36.2	2 16.3
3	.879	40.66	0.77	96.96	31.39	317.10	307.34	2 56.4	3 36.5
5	.880	40.48	0.76	96.38	30.88	297.58	287.82	4 16.6	4 56.7
7	.881	40.29	0.75	95.80	30.35	278.06	268.30	5 36.9	6 17.0
9	.882	40.10	0.73	95.21	29.80	258.54	248.78	6 57.2	7 37.3
11	0.884	39.90	0.72	94.61	29.23	239.01	229.24	8 17.5	8 57.6
13	.885	39.70	0.71	94.01	28.64	219.48	209.71	9 37.8	10 17.9
15	.886	39.50	0.70	93.40	28.03	199.94	190.17	10 58.1	11 38.3
17	.887	39.29	0.69	92.79	27.41	180.40	170.63	12 18.4	12 58.6
19	.888	39.08	0.68	92.17	26.76	160.85	151.08	13 38.8	14 19.0
21	0.889	38.87	0.66	91.55	26.09	141.30	131.53	14 59.2	15 39.4
23	.890	38.65	0.65	90.92	25.41	121.75	111.97	16 19.6	16 59.8
25	.892	38.43	0.64	90.29	24.71	102.19	92.41	17 40.1	18 20.3
27	.893	38.21	0.63	89.66	24.00	82.62	72.84	19 00.5	19 40.7
29	.894	37.98	0.62	89.03	23.27	63.05	53.26	20 21.0	21 01.2
31	0.895	37.75	0.61	88.40	22.52	43.47	33.68	21 41.5	22 21.8
Nov. 2	.897	37.52	0.60	87.77	21.76	23.89	14.10	23 02.0	23 42.3
4	.898	37.28	0.59	87.13	20.98	4.30	354.50	.. ..	0 22.6
6	.899	37.04	0.58	86.50	20.19	344.70	334.90	1 02.9	1 43.2
8	.900	36.80	0.57	85.87	19.39	325.10	315.30	2 23.5	3 03.8
10	0.902	36.56	0.55	85.25	18.57	305.49	295.68	3 44.1	4 24.5
12	.903	36.31	0.54	84.63	17.75	285.87	276.06	5 04.8	5 45.2
14	.904	36.06	0.53	84.01	16.91	266.25	256.44	6 25.5	7 05.9
16	.905	35.81	0.52	83.40	16.06	246.62	236.80	7 46.2	8 26.6
18	.907	35.55	0.51	82.79	15.20	226.98	217.16	9 07.0	9 47.4
20	0.908	35.30	0.50	82.19	14.34	207.33	197.51	10 27.8	11 08.2
22	.909	35.04	0.49	81.59	13.46	187.68	177.85	11 48.6	12 29.1
24	.911	34.78	0.48	81.00	12.58	168.02	158.18	13 09.5	13 49.9
26	.912	34.51	0.47	80.42	11.69	148.35	138.51	14 30.4	15 10.9
28	.913	34.25	0.46	79.85	10.79	128.67	118.82	15 51.3	16 31.8
30	0.915	33.98	0.45	79.29	9.89	108.98	99.13	17 12.3	17 52.8
Dec. 2	.916	33.71	0.44	78.74	8.97	89.28	79.43	18 33.4	19 13.9
4	.917	33.43	0.44	78.20	8.06	69.57	59.72	19 54.4	20 35.0
6	.919	33.16	0.43	77.66	7.14	49.86	39.99	21 15.5	21 56.1
8	.920	32.88	0.42	77.14	6.21	30.13	20.26	22 36.7	23 17.2
10	0.921	32.60	0.41	76.63	5.28	10.40	0.53	23 57.8	.. ..
12	.923	32.32	0.40	76.14	4.35	350.65	340.78	0 38.4	1 19.1
14	.924	32.04	0.39	75.65	3.41	330.90	321.02	1 59.7	2 40.3
16	.925	31.75	0.38	75.18	2.48	311.14	301.25	3 21.0	4 01.6
18	.926	31.46	0.37	74.72	1.54	291.36	281.47	4 42.3	5 23.0
20	0.928	31.18	0.36	74.27	0.60	271.58	261.69	6 03.7	6 44.4
22	.929	30.89	0.36	73.83	359.65	251.79	241.89	7 25.1	8 05.8
24	.930	30.59	0.35	73.41	358.71	231.99	222.09	8 46.5	9 27.3
26	.932	30.30	0.34	73.00	357.77	212.18	202.27	10 08.0	10 48.8
28	.933	30.00	0.33	72.61	356.82	192.36	182.45	11 29.5	12 10.3
30	0.934	29.71	0.32	72.23	355.88	172.53	162.62	12 51.1	13 31.9
32	0.936	29.41	0.31	71.86	354.94	152.70	142.78	14 12.7	14 53.5

JUPITER, 1967
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h UNIVERSAL TIME

Date	Light-time	Stellar Magnitude	Diameter		A_E+180°	D_E	A_S+180°	D_S
			Equatorial	Polar				
	m		"	"	°	°	°	°
Jan. - 2	36.12	-2.1	45.30	42.28	345.89	+0.76	341.28	+0.99
2	35.93	2.1	45.55	42.51	345.43 ⁻⁴⁶	0.77	341.60	0.97
6	35.77	2.2	45.75	42.70	344.94 ⁴⁹	0.77	341.93	0.95
10	35.65	2.2	45.91	42.85	344.44 ⁵⁰	0.78	342.25	0.94
14	35.57	2.2	46.01	42.94	343.91 ⁵³	0.78	342.58	0.92
					53			
18	35.53	-2.2	46.05	42.98	343.38	+0.79	342.90	+0.90
22	35.54	2.2	46.04	42.97	342.84 ⁻⁵⁴	0.80	343.23	0.89
26	35.59	2.2	45.98	42.92	342.31 ⁵³	0.80	343.55	0.87
30	35.68	2.2	45.86	42.81	341.78 ⁵³	0.81	343.88	0.85
Feb. 3	35.81	2.1	45.70	42.65	341.27 ⁵¹	0.82	344.20	0.84
					48			
7	35.99	-2.1	45.48	42.45	340.79	+0.83	344.52	+0.82
11	36.20	2.1	45.21	42.20	340.33 ⁻⁴⁶	0.84	344.85	0.80
15	36.45	2.1	44.90	41.91	339.90 ⁴³	0.84	345.17	0.79
19	36.73	2.1	44.56	41.59	339.51 ³⁹	0.85	345.49	0.77
23	37.05	2.1	44.17	41.23	339.16 ³⁵	0.86	345.82	0.75
					31			
27	37.40	-2.1	43.76	40.84	338.85	+0.86	346.14	+0.74
Mar. 3	37.77	2.0	43.32	40.44	338.59 ⁻²⁶	0.87	346.46	0.72
7	38.18	2.0	42.86	40.01	338.38 ²¹	0.87	346.79	0.70
11	38.61	2.0	42.39	39.56	338.22 ¹⁶	0.88	347.11	0.69
15	39.06	2.0	41.90	39.11	338.11 ¹¹	0.88	347.43	0.67
					5			
19	39.53	-1.9	41.40	38.64	338.06	+0.88	347.75	+0.65
23	40.01	1.9	40.90	38.17	338.05 ⁻¹	0.88	348.07	0.63
27	40.51	1.9	40.39	37.70	338.10 ⁺⁵	0.88	348.40	0.62
31	41.03	1.8	39.89	37.23	338.19 ⁹	0.87	348.72	0.60
Apr. 4	41.55	1.8	39.39	36.76	338.34 ¹⁵	0.87	349.04	0.58
					19			
8	42.07	-1.8	38.90	36.30	338.53	+0.87	349.36	+0.57
12	42.61	1.8	38.41	35.85	338.78 ⁺²⁵	0.86	349.68	0.55
16	43.14	1.7	37.94	35.41	339.06 ²⁸	0.85	350.00	0.53
20	43.67	1.7	37.47	34.97	339.39 ³³	0.84	350.32	0.52
24	44.20	1.7	37.02	34.55	339.77 ³⁸	0.83	350.64	0.50
					41			
28	44.73	-1.7	36.59	34.15	340.18	+0.82	350.96	+0.48
May 2	45.25	1.6	36.16	33.75	340.63 ⁺⁴⁵	0.81	351.28	0.47
6	45.77	1.6	35.76	33.37	341.12 ⁴⁹	0.79	351.60	0.45
10	46.27	1.6	35.37	33.01	341.64 ⁵²	0.78	351.92	0.43
14	46.77	1.6	34.99	32.66	342.20 ⁵⁶	0.76	352.24	0.41
					59			
18	47.25	-1.5	34.64	32.33	342.79	+0.75	352.56	+0.40
22	47.71	1.5	34.30	32.01	343.40 ⁺⁶¹	0.73	352.88	0.38
26	48.17	1.5	33.98	31.71	344.05 ⁶⁵	0.71	353.20	0.36
30	48.60	1.5	33.67	31.43	344.72 ⁶⁷	0.69	353.52	0.35
June 3	49.02	1.4	33.38	31.16	345.41 ⁶⁹	0.67	353.84	0.33
					71			
7	49.42	-1.4	33.11	30.90	346.12	+0.64	354.16	+0.31
11	49.80	1.4	32.86	30.67	346.86 ⁺⁷⁴	0.62	354.48	0.30
15	50.16	1.4	32.62	30.45	347.61 ⁷⁵	0.59	354.79	0.28
19	50.50	1.4	32.40	30.24	348.38 ⁷⁷	0.57	355.11	0.26
23	50.82	1.4	32.20	30.05	349.17 ⁷⁹	0.54	355.43	0.24
					81			
27	51.11	-1.4	32.02	29.88	349.98	+0.51	355.75	+0.23
July 1	51.38	-1.3	31.85	29.72	350.79 ⁺⁸¹	+0.48	356.07	+0.21

JUPITER, 1967

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

325

Date	<i>i</i>	Defect of Illumination	Position Angle of		Central Meridian		
			Defect	Axis	System I	System II	Correction for Phase
	°	"	°	°	°	°	°
Jan. - 2	4.62	0.07	282.07	14.84	59.59	227.12	+0.09
2	3.83 ⁻⁷⁹	.05	281.64	14.67	331.77	108.78	.06
6	3.02 ⁸¹	.03	281.05	14.49	243.95	350.44	.04
10	2.19 ⁸³	.02	280.13	14.30	156.13	232.10	.02
14	1.34 ⁸⁵	.01	278.27	14.10	68.30	113.76	+ .01
18	0.49 ⁻⁸⁵	0.00	270.56	13.90	340.46	355.39	0.00
22	0.40 ^{..}	.00	116.64	13.69	252.59	237.00	.00
26	1.25 ⁺⁸⁵	.01	106.46	13.49	164.70	118.59	- .01
30	2.09 ⁸⁴	.02	104.38	13.28	76.76	0.14	.02
Feb. 3	2.92 ⁸³	.03	103.39	13.08	348.79	241.65	.04
7	3.74 ⁸²	0.05	102.76	12.89	260.77	123.11	-0.06
11	4.52 ⁺⁷⁸	.07	102.30	12.71	172.71	4.52	.09
15	5.27 ⁷⁵	.09	101.93	12.54	84.58	245.88	.12
19	5.98 ⁷¹	.12	101.63	12.38	356.40	127.18	.16
23	6.66 ⁶⁸	.15	101.37	12.24	268.15	8.42	.19
27	7.28 ⁶²	0.18	101.15	12.12	179.85	249.59	-0.23
Mar. 3	7.87 ⁺⁵⁹	.20	100.97	12.01	91.48	130.70	.27
7	8.40 ⁵³	.23	100.81	11.93	3.04	11.75	.31
11	8.88 ⁴⁸	.25	100.69	11.86	274.54	252.73	.34
15	9.31 ⁴³	.28	100.58	11.82	185.97	133.65	.38
19	9.69 ³⁸	0.30	100.51	11.79	97.34	14.50	-0.41
23	10.02 ⁺³³	.31	100.46	11.79	8.65	255.29	.44
27	10.30 ²⁸	.33	100.43	11.81	279.90	136.02	.46
31	10.52 ²²	.34	100.42	11.85	191.10	16.70	.48
Apr. 4	10.70 ¹⁸	.34	100.44	11.91	102.23	257.32	.50
8	10.82 ¹²	0.35	100.47	11.99	13.32	137.88	-0.51
12	10.90 ^{+ 8}	.35	100.53	12.09	284.35	18.40	.52
16	10.94 ^{+ 4}	.34	100.60	12.20	195.34	258.87	.52
20	10.92 ^{- 2}	.34	100.69	12.34	106.28	139.30	.52
24	10.87 ⁵	.33	100.79	12.49	17.18	19.68	.51
28	10.78 ⁹	0.32	100.91	12.65	288.05	260.03	-0.51
May 2	10.65 ⁻¹³	.31	101.04	12.83	198.88	140.34	.49
6	10.48 ¹⁷	.30	101.19	13.03	109.68	20.62	.48
10	10.28 ²⁰	.28	101.34	13.23	20.45	260.87	.46
14	10.04 ²⁴	.27	101.51	13.45	291.19	141.10	.44
18	9.77 ²⁷	0.25	101.68	13.68	201.91	21.30	-0.42
22	9.47 ⁻³⁰	.23	101.86	13.92	112.61	261.48	.39
26	9.15 ³²	.22	102.04	14.16	23.29	141.65	.36
30	8.80 ³⁵	.20	102.23	14.41	293.95	21.80	.34
June 3	8.43 ³⁷	.18	102.42	14.67	204.61	261.93	.31
7	8.03 ⁴⁰	0.16	102.62	14.94	115.25	142.05	-0.28
11	7.61 ⁻⁴²	.14	102.81	15.21	25.88	22.17	.25
15	7.18 ⁴³	.13	102.99	15.48	296.50	262.27	.22
19	6.72 ⁴⁶	.11	103.17	15.76	207.13	142.38	.20
23	6.25 ⁴⁷	.10	103.35	16.04	117.74	22.48	.17
27	5.77 ⁴⁸	0.08	103.50	16.32	28.36	262.58	-0.15
July 1	5.27 ⁻⁵⁰	0.07	103.64	16.60	298.98	142.68	-0.12

JUPITER, 1967
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h UNIVERSAL TIME

Date	Light-time	Stellar Magnitude	Diameter		A_E+180°	D_E	A_S+180°	D_S		
			Equatorial	Polar						
	m		"	"	°	°	°	°		
July	1	51.38	-1.3	31.85	29.72	350.79	+0.48	356.07	+0.21	
	5	51.63	1.3	31.70	29.58	351.62 ⁺⁸³	0.45	356.38	0.19	
	9	51.85	1.3	31.56	29.46	352.46 ⁸⁴	0.42	356.70	0.18	
	13	52.05	1.3	31.44	29.35	353.31 ⁸⁵	0.39	357.02	0.16	
	17	52.22	1.3	31.34	29.25	354.16 ⁸⁵	0.36	357.34	0.14	
	21	52.36	-1.3	31.25	29.17	355.03	+0.33	357.65	+0.13	
	25	52.48	1.3	31.18	29.10	355.89 ⁺⁸⁶	0.29	357.97	0.11	
	29	52.57	1.3	31.13	29.05	356.77 ⁸⁸	0.26	358.29	0.09	
Aug.	2	52.64	1.3	31.09	29.02	357.64 ⁸⁷	0.23	358.60	0.07	
	6	52.68	1.3	31.07	29.00	358.52 ⁸⁸	0.19	358.92	0.06	
	10	52.69	-1.3	31.06	28.99	359.40	+0.15	359.24	+0.04	
	14	52.67	1.3	31.07	29.00	0.28 ⁺⁸⁸	0.12	359.55	0.02	
	18	52.63	1.3	31.10	29.02	1.15 ⁸⁷	0.08	359.87	+0.01	
	22	52.55	1.3	31.14	29.06	2.03 ⁸⁸	0.04	0.18	-0.01	
	26	52.46	1.3	31.20	29.12	2.90 ⁸⁷	+0.01	0.50	0.03	
	30	52.33	-1.3	31.27	29.19	3.76 ⁸⁶	-0.03	0.81	-0.04	
	Sept.	3	52.18	1.3	31.36	29.27	4.62 ⁺⁸⁶	0.07	1.13	0.06
		7	52.00	1.3	31.47	29.37	5.46 ⁸⁴	0.11	1.45	0.08
	11	51.80	1.3	31.60	29.49	6.30 ⁸⁴	0.14	1.76	0.09	
	15	51.57	1.3	31.74	29.62	7.13 ⁸³	0.18	2.08	0.11	
	19	51.31	-1.3	31.89	29.77	7.95 ⁸²	-0.22	2.39	-0.13	
	23	51.03	1.4	32.07	29.93	8.75 ⁺⁸⁰	0.26	2.71	0.15	
	27	50.73	1.4	32.26	30.11	9.53 ⁷⁸	0.30	3.02	0.16	
	Oct.	1	50.40	1.4	32.47	30.30	10.30 ⁷⁷	0.34	3.33	0.18
		5	50.05	1.4	32.70	30.52	11.05 ⁷⁵	0.37	3.65	0.20
		9	49.68	-1.4	32.94	30.74	11.78 ⁷³	-0.41	3.96	-0.21
13		49.29	1.4	33.20	30.99	12.49 ⁺⁷¹	0.45	4.28	0.23	
17		48.88	1.4	33.48	31.25	13.18 ⁶⁹	0.49	4.59	0.25	
21		48.45	1.5	33.78	31.52	13.84 ⁶⁶	0.52	4.90	0.26	
25		48.01	1.5	34.09	31.82	14.47 ⁶³	0.56	5.22	0.28	
29		47.54	-1.5	34.42	32.13	15.07 ⁶⁰	-0.59	5.53	-0.30	
Nov.		2	47.07	1.5	34.77	32.45	15.65 ⁺⁵⁸	0.63	5.85	0.31
		6	46.58	1.5	35.13	32.79	16.19 ⁵⁴	0.66	6.16	0.33
	10	46.08	1.6	35.51	33.15	16.69 ⁵⁰	0.70	6.47	0.35	
	14	45.57	1.6	35.91	33.52	17.16 ⁴⁷	0.73	6.78	0.36	
	18	45.06	-1.6	36.32	33.90	17.59 ⁴³	-0.76	7.10	-0.38	
	22	44.54	1.6	36.75	34.30	17.97 ⁺³⁸	0.79	7.41	0.40	
	26	44.01	1.7	37.18	34.70	18.32 ³⁵	0.82	7.72	0.41	
	30	43.49	1.7	37.63	35.12	18.62 ³⁰	0.85	8.03	0.43	
	Dec.	4	42.96	1.7	38.09	35.55	18.87 ²⁵	0.87	8.35	0.45
		8	42.44	-1.7	38.56	35.99	19.08 ²¹	-0.90	8.66	-0.46
	12	41.93	1.8	39.03	36.43	19.24 ⁺¹⁶	0.92	8.97	0.48	
	16	41.42	1.8	39.51	36.88	19.35 ¹¹	0.94	9.28	0.50	
	20	40.92	1.8	39.99	37.32	19.40 ⁵	0.96	9.60	0.51	
	24	40.44	1.8	40.46	37.77	19.41 ⁺¹	0.98	9.91	0.53	
	28	39.98	-1.9	40.94	38.21	19.36 ⁻⁵	-1.00	10.22	-0.55	
	32	39.53	-1.9	41.40	38.64	19.26 ⁻¹⁰	-1.01	10.53	-0.56	

JUPITER, 1967

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

327

Date		<i>i</i>	Defect of Illumination	Position Angle of		Central Meridian		Correction for Phase
				Defect	Axis	System I	System II	
		°	"	°	°	°	°	°
July	1	5.27	0.07	103.64	16.60	298.98	142.68	-0.12
	5	4.76 ⁻⁵¹	.05	103.75	16.89	209.60	22.78	.10
	9	4.24 ⁵²	.04	103.83	17.17	120.23	262.89	.08
	13	3.71 ⁵³	.03	103.84	17.45	30.86	143.00	.06
	17	3.17 ⁵⁴	.02	103.78	17.73	301.50	23.12	.04
		⁵⁵						
	21	2.62	0.02	103.57	18.00	212.15	263.25	-0.03
	25	2.07 ⁻⁵⁵	.01	103.11	18.28	122.81	143.39	.02
	29	1.52 ⁵⁵	.01	102.13	18.55	33.48	23.54	— .01
		⁵⁶						
Aug.	2	0.96	.00	99.71	18.81	304.16	263.71	.00
	6	0.41 ⁻⁵⁵	.00	90.00	19.08	214.86	143.89	.00
		^{..}						
	10	0.21	0.00	322.66	19.33	125.58	24.08	0.00
	14	0.74 ⁺⁵³	.00	297.01	19.59	36.31	264.29	.00
	18	1.30 ⁵⁶	.00	293.20	19.83	307.06	144.53	+ .01
	22	1.85 ⁵⁵	.01	291.81	20.07	217.83	24.78	.02
	26	2.41 ⁵⁶	.01	291.16	20.31	128.62	265.05	.03
		⁵⁴						
	30	2.95	0.02	290.83	20.54	39.44	145.34	+0.04
Sept.	3	3.50 ⁺⁵⁵	.03	290.67	20.76	310.27	25.65	.05
	7	4.03 ⁵³	.04	290.59	20.97	221.13	265.99	.07
	11	4.55 ⁵²	.05	290.58	21.18	132.02	146.36	.09
	15	5.07 ⁵²	.06	290.60	21.38	42.93	26.75	.11
		⁵⁰						
	19	5.57	0.08	290.64	21.57	313.87	267.17	+0.14
	23	6.05 ⁺⁴⁸	.09	290.70	21.76	224.84	147.62	.16
	27	6.52 ⁴⁷	.10	290.77	21.94	135.84	28.09	.19
	Oct. 1	6.98 ⁴⁶	.12	290.85	22.11	46.87	268.60	.21
	5	7.42 ⁴⁴	.14	290.92	22.27	317.93	149.14	.24
		⁴¹						
	9	7.83	0.15	291.00	22.42	229.03	29.71	+0.27
	13	8.23 ⁺⁴⁰	.17	291.07	22.57	140.16	270.32	.29
	17	8.60 ³⁷	.19	291.14	22.70	51.32	150.97	.32
	21	8.94 ³⁴	.21	291.21	22.83	322.52	31.64	.35
	25	9.26 ³²	.22	291.27	22.95	233.76	272.36	.37
		²⁹						
	29	9.55	0.24	291.33	23.07	145.04	153.12	+0.40
	Nov. 2	9.81 ⁺²⁶	.25	291.38	23.17	56.36	33.91	.42
	6	10.04 ²³	.27	291.42	23.27	327.72	274.75	.44
	10	10.23 ¹⁹	.28	291.45	23.36	239.12	155.62	.46
	14	10.38 ¹⁵	.29	291.48	23.44	150.56	36.54	.47
		¹²						
	18	10.50	0.30	291.50	23.51	62.05	277.51	+0.48
	22	10.58 ^{+ 8}	.31	291.51	23.58	333.57	158.51	.49
	26	10.61 ^{+ 3}	.32	291.50	23.63	245.15	39.57	.49
	30	10.60 ^{- 1}	.32	291.49	23.68	156.77	280.66	.49
	Dec. 4	10.54 ⁶	.32	291.47	23.72	68.43	161.81	.48
		¹¹						
	8	10.43	0.32	291.43	23.76	340.14	42.99	+0.47
	12	10.28 ⁻¹⁵	.31	291.39	23.78	251.90	284.23	.46
	16	10.07 ²¹	.30	291.32	23.80	163.70	165.51	.44
	20	9.82 ²⁵	.29	291.25	23.81	75.55	46.83	.42
	24	9.51 ³¹	.28	291.16	23.81	347.44	288.20	.39
		³⁶						
	28	9.15	0.26	291.04	23.81	259.37	169.61	+0.36
	32	8.74 ⁻⁴¹	0.24	290.91	23.79	171.34	51.05	+0.33

EPHEMERIS FOR PHYSICAL OBSERVATIONS

LONGITUDE OF CENTRAL MERIDIAN OF ILLUMINATED DISK

SYSTEM I

Day (0 ^h U.T.)	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
	°	°	°	°	°	°	°	°	°	°	°	°
1	173.8	32.8	135.4	348.4	40.7	249.0	298.9	146.5	354.9	47.1	258.9	315.2
2	331.8	190.8	293.3	146.2	198.4	46.6	96.5	304.2	152.6	204.9	56.8	113.1
3	129.9	348.8	91.2	304.0	356.1	204.3	254.2	101.8	310.3	2.6	214.6	271.0
4	287.9	146.7	249.1	101.7	153.8	2.0	51.8	259.5	108.0	160.4	12.5	68.9
5	85.9	304.7	47.0	259.5	311.5	159.6	209.5	57.2	265.8	318.2	170.3	226.8
6	244.0	102.7	204.9	57.3	109.2	317.3	7.2	214.9	63.5	115.9	328.2	24.8
7	42.0	260.7	2.7	215.0	266.9	115.0	164.8	12.5	221.2	273.7	126.0	182.7
8	200.1	58.7	160.6	12.8	64.6	272.6	322.5	170.2	18.9	71.5	283.9	340.6
9	358.1	216.7	318.5	170.6	222.3	70.3	120.2	327.9	176.7	229.3	81.7	138.6
10	156.2	14.6	116.3	328.3	20.0	228.0	277.8	125.6	334.4	27.1	239.6	296.5
11	314.2	172.6	274.2	126.1	177.7	25.6	75.5	283.3	132.1	184.9	37.4	94.4
12	112.2	330.6	72.1	283.8	335.4	183.3	233.1	80.9	289.8	342.7	195.3	252.4
13	270.3	128.5	229.9	81.6	133.1	341.0	30.8	238.6	87.6	140.5	353.2	50.3
14	68.3	286.5	27.8	239.3	290.7	138.6	188.5	36.3	245.3	298.2	151.0	208.2
15	226.3	84.5	185.6	37.1	88.4	296.3	346.1	194.0	43.0	96.0	308.9	6.2
16	24.4	242.4	343.4	194.8	246.1	93.9	143.8	351.7	200.8	253.8	106.8	164.1
17	182.4	40.4	141.3	352.6	43.8	251.6	301.5	149.4	358.5	51.6	264.6	322.1
18	340.5	198.3	299.1	150.3	201.5	49.3	99.1	307.1	156.3	209.4	62.5	120.1
19	138.5	356.2	96.9	308.0	359.2	206.9	256.8	104.7	314.0	7.3	220.4	278.0
20	296.5	154.2	254.8	105.8	156.9	4.6	54.5	262.5	111.8	165.1	18.3	76.0
21	94.6	312.1	52.6	263.5	314.5	162.3	212.1	60.2	269.5	322.9	176.2	233.9
22	252.6	110.0	210.4	61.2	112.2	319.9	9.8	217.8	67.2	120.7	334.1	31.9
23	50.6	268.0	8.2	218.9	269.9	117.6	167.5	15.5	225.0	278.5	132.0	189.9
24	208.6	65.9	166.0	16.7	67.6	275.2	325.1	173.2	22.8	76.3	289.8	347.8
25	6.7	223.8	323.8	174.4	225.2	72.9	122.8	330.9	180.5	234.1	87.7	145.8
26	164.7	21.7	121.6	332.1	22.9	230.6	280.5	128.6	338.3	32.0	245.6	303.8
27	322.7	179.6	279.4	129.8	180.6	28.2	78.1	286.4	136.0	189.8	43.5	101.8
28	120.7	337.5	77.2	287.5	338.3	185.9	235.8	84.1	293.8	347.6	201.4	259.7
29	278.7		235.0	85.3	135.9	343.5	33.5	241.8	91.5	145.4	359.3	57.7
30	76.7		32.8	243.0	293.6	141.2	191.1	39.5	249.3	303.3	157.3	215.7
31	234.8		190.6		91.3		348.8	197.2		101.1		13.7

MOTION OF THE CENTRAL MERIDIAN

	0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	8 ^h	9 ^h	10 ^h	11 ^h
m	°	°	°	°	°	°	°	°	°	°	°	°
0	0.0	36.6	73.2	109.7	146.3	182.9	219.5	256.1	292.7	329.2	5.8	42.4
5	3.0	39.6	76.2	112.8	149.4	186.0	222.5	259.1	295.7	332.3	8.9	45.4
10	6.1	42.7	79.3	115.8	152.4	189.0	225.6	262.2	298.7	335.3	11.9	48.5
15	9.1	45.7	82.3	118.9	155.5	192.1	228.6	265.2	301.8	338.4	15.0	51.5
20	12.2	48.8	85.4	121.9	158.5	195.1	231.7	268.3	304.8	341.4	18.0	54.6
25	15.2	51.8	88.4	125.0	161.6	198.1	234.7	271.3	307.9	344.5	21.1	57.6
30	18.3	54.9	91.5	128.0	164.6	201.2	237.8	274.4	310.9	347.5	24.1	60.7
35	21.3	57.9	94.5	131.1	167.7	204.2	240.8	277.4	314.0	350.6	27.2	63.7
40	24.4	61.0	97.6	134.1	170.7	207.3	243.9	280.5	317.0	353.6	30.2	66.8
45	27.4	64.0	100.6	137.2	173.8	210.3	246.9	283.5	320.1	356.7	33.2	69.8
50	30.5	67.1	103.6	140.2	176.8	213.4	250.0	286.6	323.1	359.7	36.3	72.9
55	33.5	70.1	106.7	143.3	179.9	216.4	253.0	289.6	326.2	2.8	39.3	75.9
60	36.6	73.2	109.7	146.3	182.9	219.5	256.1	292.7	329.2	5.8	42.4	79.0

EPHEMERIS FOR PHYSICAL OBSERVATIONS

LONGITUDE OF CENTRAL MERIDIAN OF ILLUMINATED DISK

SYSTEM II

Day (0 ^h U.T.)	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
	°	°	°	°	°	°	°	°	°	°	°	°
1	318.4	300.9	189.9	166.4	349.8	321.5	142.6	113.7	85.5	268.8	244.1	71.4
2	108.8	91.2	340.2	316.5	139.8	111.6	292.6	263.7	235.6	59.0	34.3	221.7
3	259.3	241.6	130.4	106.7	289.9	261.6	82.6	53.7	25.7	209.1	184.5	12.0
4	49.7	32.0	280.7	256.8	80.0	51.7	232.7	203.8	175.8	359.2	334.8	162.3
5	200.1	182.3	70.9	47.0	230.1	201.7	22.7	353.8	325.9	149.4	125.0	312.6
6	350.5	332.7	221.2	197.1	20.1	351.7	172.7	143.9	116.0	299.5	275.2	102.9
7	140.9	123.0	11.4	347.2	170.2	141.8	322.7	293.9	266.1	89.7	65.4	253.2
8	291.3	273.4	161.7	137.4	320.3	291.8	112.8	84.0	56.2	239.8	215.6	43.5
9	81.7	63.7	311.9	287.5	110.4	81.8	262.8	234.0	206.3	30.0	5.9	193.8
10	232.1	214.1	102.2	77.6	260.4	231.9	52.8	24.1	356.3	180.1	156.1	344.1
11	22.5	4.4	252.4	227.8	50.5	21.9	202.9	174.1	146.4	330.3	306.3	134.4
12	172.9	154.8	42.6	17.9	200.5	171.9	352.9	324.2	296.5	120.5	96.5	284.7
13	323.4	305.1	192.8	168.0	350.6	322.0	142.9	114.2	86.7	270.6	246.8	75.0
14	113.8	95.4	343.1	318.1	140.7	112.0	293.0	264.3	236.8	60.8	37.0	225.3
15	264.2	245.8	133.3	108.2	290.7	262.0	83.0	54.3	26.9	210.9	187.3	15.6
16	54.6	36.1	283.5	258.3	80.8	52.1	233.0	204.4	177.0	1.1	337.5	165.9
17	205.0	186.4	73.7	48.5	230.8	202.1	23.1	354.5	327.1	151.3	127.7	316.3
18	355.4	336.7	223.9	198.6	20.9	352.1	173.1	144.5	117.2	301.5	278.0	106.6
19	145.8	127.0	14.1	348.7	170.9	142.2	323.1	294.6	267.3	91.6	68.2	256.9
20	296.2	277.3	164.3	138.8	321.0	292.2	113.2	84.7	57.4	241.8	218.5	47.2
21	86.6	67.6	314.5	288.9	111.0	82.2	263.2	234.7	207.5	32.0	8.7	197.6
22	237.0	217.9	104.7	79.0	261.1	232.3	53.3	24.8	357.7	182.2	159.0	347.9
23	27.4	8.2	254.9	229.1	51.1	22.3	203.3	174.9	147.8	332.4	309.3	138.3
24	177.8	158.5	45.0	19.2	201.2	172.3	353.3	324.9	297.9	122.5	99.5	288.6
25	328.2	308.8	195.2	169.3	351.2	322.4	143.4	115.0	88.0	272.7	249.8	78.9
26	118.6	99.1	345.4	319.3	141.3	112.4	293.4	265.1	238.2	62.9	40.1	229.3
27	269.0	249.4	135.6	109.4	291.3	262.4	83.5	55.1	28.3	213.1	190.3	19.6
28	59.4	39.6	285.7	259.5	81.4	52.5	233.5	205.2	178.4	3.3	340.6	170.0
29	209.7		75.9	49.6	231.4	202.5	23.5	355.3	328.5	153.5	130.9	320.3
30	0.1		226.1	199.7	21.5	352.5	173.6	145.4	118.7	303.7	281.2	110.7
31	150.5		16.2		171.5		323.6	295.5		93.9		261.0

MOTION OF THE CENTRAL MERIDIAN

	0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	8 ^h	9 ^h	10 ^h	11 ^h
	°	°	°	°	°	°	°	°	°	°	°	°
m												
0	0.0	36.3	72.5	108.8	145.1	181.3	217.6	253.8	290.1	326.4	2.6	38.9
5	3.0	39.3	75.5	111.8	148.1	184.3	220.6	256.9	293.1	329.4	5.7	41.9
10	6.0	42.3	78.6	114.8	151.1	187.4	223.6	259.9	296.1	332.4	8.7	44.9
15	9.1	45.3	81.6	117.9	154.1	190.4	226.6	262.9	299.2	335.4	11.7	48.0
20	12.1	48.4	84.6	120.9	157.1	193.4	229.7	265.9	302.2	338.5	14.7	51.0
25	15.1	51.4	87.6	123.9	160.2	196.4	232.7	268.9	305.2	341.5	17.7	54.0
30	18.1	54.4	90.7	126.9	163.2	199.4	235.7	272.0	308.2	344.5	20.8	57.0
35	21.2	57.4	93.7	129.9	166.2	202.5	238.7	275.0	311.3	347.5	23.8	60.0
40	24.2	60.4	96.7	133.0	169.2	205.5	241.8	278.0	314.3	350.5	26.8	63.1
45	27.2	63.5	99.7	136.0	172.2	208.5	244.8	281.0	317.3	353.6	29.8	66.1
50	30.2	66.5	102.7	139.0	175.3	211.5	247.8	284.1	320.3	356.6	32.8	69.1
55	33.2	69.5	105.8	142.0	178.3	214.6	250.8	287.1	323.3	359.6	35.9	72.1
60	36.3	72.5	108.8	145.1	181.3	217.6	253.8	290.1	326.4	2.6	38.9	75.1

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

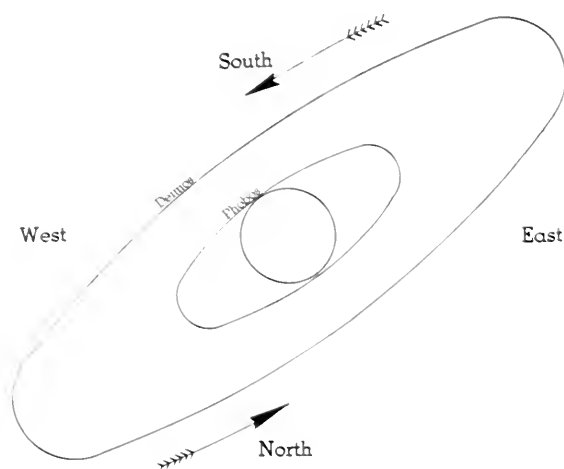
Date	Light-time	Stellar Magnitude	Diameter		<i>i</i>	Defect of Illumination	Position Angle of Defect
			Equatorial	Polar			
	m		"	"	°	"	°
Jan. - 2	80.64	+1.4	17.17	15.37	5.77	0.04	67.14
2	81.17	1.4	17.06	15.27	5.67	.04	67.29
6	81.69	1.4	16.95	15.17	5.54	.04	67.44
10	82.20	1.4	16.85	15.08	5.39	.04	67.60
14	82.70	1.4	16.75	14.99	5.22	.03	67.76
18	83.17	+1.4	16.65	14.90	5.03	0.03	67.94
22	83.63	1.4	16.56	14.82	4.82	.03	68.13
26	84.07	1.4	16.47	14.74	4.59	.03	68.34
30	84.48	1.3	16.39	14.67	4.34	.02	68.57
Feb. 3	84.87	1.3	16.32	14.60	4.07	.02	68.83
7	85.24	+1.3	16.25	14.54	3.79	0.02	69.12
11	85.58	1.3	16.18	14.48	3.50	.02	69.47
15	85.89	1.3	16.12	14.43	3.19	.01	69.88
19	86.17	+1.3	16.07	14.38	2.88	0.01	70.38
..
Apr. 24	86.27	+1.1	16.05	14.37	2.75	0.01	242.49
28	86.00	1.1	16.10	14.41	3.07	.01	243.05
May 2	85.71	1.1	16.16	14.46	3.39	.01	243.52
6	85.39	1.1	16.22	14.51	3.69	.02	243.92
10	85.04	1.1	16.28	14.57	3.98	.02	244.26
14	84.67	+1.1	16.36	14.64	4.25	0.02	244.56
18	84.27	1.1	16.43	14.71	4.51	.03	244.83
22	83.86	1.1	16.52	14.78	4.76	.03	245.07
26	83.42	1.1	16.60	14.86	4.99	.03	245.30
30	82.96	1.1	16.69	14.94	5.20	.03	245.51
June 3	82.48	+1.1	16.79	15.03	5.39	0.04	245.71
7	81.99	1.1	16.89	15.12	5.57	.04	245.90
11	81.48	1.0	17.00	15.21	5.72	.04	246.08
15	80.96	1.0	17.11	15.31	5.85	.04	246.26
19	80.43	1.0	17.22	15.41	5.96	.05	246.43
23	79.89	+1.0	17.33	15.51	6.05	0.05	246.60
27	79.35	1.0	17.45	15.62	6.11	.05	246.76
July 1	78.80	1.0	17.58	15.73	6.15	.05	246.93
5	78.24	1.0	17.70	15.84	6.16	.05	247.09
9	77.69	1.0	17.83	15.95	6.15	.05	247.26
13	77.14	+0.9	17.95	16.06	6.11	0.05	247.42
17	76.60	0.9	18.08	16.18	6.04	.05	247.60
21	76.06	0.9	18.21	16.29	5.95	.05	247.78
25	75.53	0.9	18.33	16.41	5.83	.05	247.96
29	75.02	+0.9	18.46	16.52	5.68	0.05	248.16

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date		Light-time	Stellar Magnitude	Diameter		<i>i</i>	Defect of Illumination	Position Angle of Defect
				Equatorial	Polar			
		m		"	"	°	"	°
July	29	75.02	+0.9	18.46	16.52	5.68	0.05	248.16
Aug.	2	74.52	0.8	18.58	16.63	5.50	.04	248.37
	6	74.03	0.8	18.71	16.74	5.30	.04	248.60
	10	73.57	0.8	18.82	16.85	5.07	.04	248.85
	14	73.12	0.8	18.94	16.95	4.82	.03	249.12
	18	72.70	+0.7	19.05	17.05	4.54	0.03	249.43
	22	72.31	0.7	19.15	17.14	4.23	.03	249.79
	26	71.94	0.7	19.25	17.23	3.91	.02	250.21
	30	71.61	0.7	19.34	17.31	3.56	.02	250.71
Sept.	3	71.30	0.7	19.42	17.38	3.19	.01	251.34
	7	71.03	+0.6	19.50	17.45	2.81	0.01	252.13
	11	70.80	0.6	19.56	17.51	2.41	.01	253.20
	15	70.60	0.6	19.62	17.55	1.99	.01	254.71
	19	70.44	0.6	19.66	17.59	1.57	.00	257.03
	23	70.32	0.6	19.69	17.62	1.14	.00	261.10
	27	70.24	+0.6	19.72	17.64	0.72	0.00	270.00
Oct.	1	70.20	0.6	19.73	17.65	0.36	.00	299.73
	5	70.20	0.5	19.73	17.65	0.37	.00	16.26
	9	70.24	0.6	19.72	17.64	0.74	.00	44.31
	13	70.32	0.6	19.69	17.62	1.16	.00	52.88
	17	70.44	+0.6	19.66	17.59	1.59	0.00	56.85
	21	70.60	0.7	19.61	17.55	2.01	.01	59.14
	25	70.80	0.7	19.56	17.50	2.42	.01	60.63
	29	71.04	0.7	19.49	17.44	2.82	.01	61.69
Nov.	2	71.32	0.7	19.42	17.38	3.21	.02	62.48
	6	71.63	+0.8	19.33	17.30	3.57	0.02	63.11
	10	71.97	0.8	19.24	17.22	3.91	.02	63.62
	14	72.34	0.8	19.14	17.13	4.24	.03	64.05
	18	72.74	0.8	19.04	17.04	4.53	.03	64.41
	22	73.17	0.9	18.93	16.94	4.80	.03	64.73
	26	73.62	+0.9	18.81	16.83	5.05	0.04	65.02
	30	74.10	0.9	18.69	16.73	5.27	.04	65.28
Dec.	4	74.59	0.9	18.57	16.62	5.46	.04	65.51
	8	75.10	1.0	18.44	16.50	5.62	.04	65.73
	12	75.62	1.0	18.31	16.39	5.75	.05	65.93
	16	76.16	+1.0	18.19	16.27	5.86	0.05	66.13
	20	76.70	1.0	18.06	16.16	5.93	.05	66.31
	24	77.24	1.0	17.93	16.04	5.97	.05	66.49
	28	77.80	1.0	17.80	15.93	5.99	.05	66.67
	32	78.35	+1.1	17.68	15.82	5.98	0.05	66.85

APPARENT ORBITS OF THE SATELLITES AT DATE OF OPPOSITION,
APRIL 15



NAME		SIDEREAL PERIOD		
		h	m	s
I	Phobos	7	39	13.85
II	Deimos	30	17	54.87

DEIMOS

UNIVERSAL TIME OF GREATEST EASTERN ELONGATION

	d	h		d	h		d	h		d	h
Mar. 22	12	7	Mar. 31	08.6	Apr. 10	10.7	Apr. 20	12.8	Apr. 30	14.9	
23	19	0	Apr. 1	14.9	11	17.0	21	19.0	May 1	21.2	
25	01	3	2	21.1	12	23.3	23	01.3	3	03.4	
26	07	5	4	03.4	14	05.5	24	07.6	4	09.7	
			5	09.7	15	11.8	25	13.8	5	16.0	
27	13	8	6	15.9	16	18.1	26	20.1	6	22.2	
28	20	1	7	22.2	18	00.3	28	02.4	8	04.5	
30	02	3	9	04.5	19	06.5	29	08.6			

DEIMOS

APPARENT DISTANCE AND POSITION ANGLE

Time from Eastern Elongation	F	p_1	Time from Eastern Elongation	F	p_1	Time from Eastern Elongation	F	p_1	Time from Eastern Elongation	F	p_1
h m		°	h m		°	h m		°	h m		°
0 00	1.000	126.0	8 00	0.322	231.9	16 00	0.986	309.2	24 00	0.398	77.1
0 40	0.991	128.5	8 40	0.377	252.6	16 40	0.956	311.8	24 40	0.485	89.9
1 20	0.966	131.0	9 20	0.460	266.8	17 20	0.909	314.6	25 20	0.580	98.6
2 00	0.924	133.8	10 00	0.554	276.5	18 00	0.848	317.8	26 00	0.673	104.9
2 40	0.866	136.9	10 40	0.648	283.4	18 40	0.774	321.5	26 40	0.760	109.8
3 20	0.796	140.4	11 20	0.737	288.5	19 20	0.689	326.1	27 20	0.836	113.6
4 00	0.713	144.8	12 00	0.816	292.6	20 00	0.596	332.1	28 00	0.900	116.9
4 40	0.622	150.3	12 40	0.884	296.0	20 40	0.501	340.4	28 40	0.949	119.8
5 20	0.527	157.8	13 20	0.937	298.9	21 20	0.412	352.3	29 20	0.982	122.4
6 00	0.436	168.5	14 00	0.974	301.7	22 00	0.342	10.0	30 00	0.998	124.9
6 40	0.358	184.5	14 40	0.995	304.2	22 40	0.311	33.7	30 40	0.997	127.4
7 20	0.315	206.8	15 20	0.999	306.7	23 20	0.333	58.2			

Date (0 ^h U.T.)	$\frac{a}{\Delta}$	p_2	Date (0 ^h U.T.)	$\frac{a}{\Delta}$	p_2	Date (0 ^h U.T.)	$\frac{a}{\Delta}$	p_2	Date (0 ^h U.T.)	$\frac{a}{\Delta}$	p_2
	"	°		"	°		"	°		"	°
Mar. 22	46.5	+1.3	Apr. 3	50.8	+1.0	Apr. 16	53.6	+0.3	Apr. 29	53.4	-0.7
23	46.9	1.3	4	51.1	1.0	17	53.6	0.2	30	53.3	0.8
24	47.3	1.3	5	51.4	0.9	18	53.7	0.1	May 1	53.1	0.9
25	47.7	1.3	6	51.7	0.9	19	53.8	+0.1	2	53.0	0.9
			7	51.9	0.8	20	53.8	0.0	3	52.8	1.0
26	48.1	+1.3	8	52.2	+0.8	21	53.8	-0.1	4	52.6	-1.1
27	48.5	1.2	9	52.4	0.7	22	53.8	0.2	5	52.4	1.1
28	48.8	1.2	10	52.6	0.7	23	53.8	0.2	6	52.2	1.2
29	49.2	1.2	11	52.8	0.6	24	53.8	0.3	7	52.0	1.3
30	49.5	1.2	12	53.0	0.6	25	53.8	0.4	8	51.7	1.3
31	49.9	+1.1	13	53.2	+0.5	26	53.7	-0.5	9	51.5	-1.4
Apr. 1	50.2	1.1	14	53.3	0.4	27	53.6	0.5	10	51.2	-1.5
2	50.5	+1.1	15	53.4	+0.4	28	53.5	-0.6	..	..	..

Apparent distance of satellite is $F \frac{a}{\Delta}$ Position angle of satellite is $p_1 + p_2$

SATELLITES OF MARS, 1967

PHOBOS

UNIVERSAL TIME OF GREATEST EASTERN ELONGATION

	d	h		d	h		d	h		d	h			
	Apr.	1	06.6	Apr.	10	20.1	Apr.	20	09.7	Apr.	29	23.2
Mar.	23	00.7		1	14.2		11	03.8		20	17.3		30	06.9
	23	08.3		1	21.9		11	11.4		21	01.0		30	14.5
	23	16.0		2	05.5		11	19.1		21	08.6		30	22.2
	23	23.6		2	13.2		12	02.8		21	16.3	May	1	05.8
	24	07.3		2	20.9		12	10.4		21	23.9		1	13.5
	24	14.9		3	04.5		12	18.0		22	07.6		1	21.1
	24	22.6		3	12.1		13	01.7		22	15.2		2	04.8
	25	06.2		3	19.8		13	09.3		22	22.9		2	12.4
	25	13.9		4	03.5		13	17.0		23	06.5		2	20.1
	25	21.5		4	11.1		14	00.6		23	14.2		3	03.7
26	05.2		4	18.8		14	08.3		23	21.8		3	11.4	
26	12.8		5	02.4		14	15.9		24	05.5		3	19.0	
26	20.5		5	10.1		14	23.6		24	13.1		4	02.7	
27	04.2		5	17.7		15	07.3		24	20.8		4	10.3	
27	11.8		6	01.4		15	14.9		25	04.4		4	18.0	
27	19.5		6	09.0		15	22.6		25	12.1		5	01.6	
28	03.1		6	16.7		16	06.2		25	19.7		5	09.3	
28	10.8		7	00.3		16	13.8		26	03.4		5	16.9	
28	18.4		7	08.0		16	21.5		26	11.0		6	00.6	
29	02.1		7	15.6		17	05.2		26	18.7		6	08.3	
29	09.7		7	23.3		17	12.8		27	02.4		6	15.9	
29	17.4		8	06.9		17	20.5		27	10.0		6	23.5	
30	01.0		8	14.6		18	04.1		27	17.6		7	07.2	
30	08.7		8	22.2		18	11.8		28	01.3		7	14.9	
30	16.3		9	05.9		18	19.4		28	09.0		7	22.5	
31	00.0		9	13.5		19	03.1		28	16.6		8	06.2	
31	07.6		9	21.2		19	10.7		29	00.3		8	13.8	
31	15.3		10	04.8		19	18.4		29	07.9		8	21.5	
31	23.0		10	12.5		20	02.0		29	15.6		..	...

PHOBOS

APPARENT DISTANCE AND POSITION ANGLE

Time from Eastern Elongation	F	p_1	Time from Eastern Elongation	F	p_1	Time from Eastern Elongation	F	p_1	Time from Eastern Elongation	F	p_1
h m		°	h m		°	h m		°	h m		°
0 00	1.000	126.0	2 00	0.370	227.0	4 00	0.991	309.0	6 00	0.414	66.7
0 10	0.992	128.9	2 10	0.412	246.1	4 10	0.967	312.0	6 10	0.485	81.0
0 20	0.968	131.8	2 20	0.481	260.6	4 20	0.927	315.1	6 20	0.568	91.4
0 30	0.928	135.0	2 30	0.565	271.1	4 30	0.872	318.7	6 30	0.655	99.1
0 40	0.875	138.5	2 40	0.651	278.9	4 40	0.806	322.7	6 40	0.738	105.0
0 50	0.808	142.6	2 50	0.735	284.8	4 50	0.729	327.6	6 50	0.815	109.8
1 00	0.732	147.4	3 00	0.811	289.6	5 00	0.645	333.7	7 00	0.879	113.8
1 10	0.648	153.4	3 10	0.877	293.6	5 10	0.558	342.0	7 10	0.932	117.2
1 20	0.561	161.2	3 20	0.930	297.1	5 20	0.476	352.4	7 20	0.970	120.4
1 30	0.479	171.9	3 30	0.969	300.3	5 30	0.408	7.3	7 30	0.993	123.3
1 40	0.410	186.6	3 40	0.993	303.2	5 40	0.369	26.6	7 40	1.000	126.2
1 50	0.369	205.8	3 50	1.000	306.1	5 50	0.372	47.8			

Date (0 ^h U.T.)	$\frac{a}{\Delta}$	p_2	Date (0 ^h U.T.)	$\frac{a}{\Delta}$	p_2	Date (0 ^h U.T.)	$\frac{a}{\Delta}$	p_2	Date (0 ^h U.T.)	$\frac{a}{\Delta}$	p_2
	"	°		"	°		"	°		"	°
Mar. 22	18.6	+1.4	Apr. 3	20.3	+1.0	Apr. 16	21.4	+0.2	Apr. 29	21.3	-1.1
23	18.8	1.4	4	20.4	0.9	17	21.4	+0.1	30	21.3	1.2
24	18.9	1.3	5	20.5	0.9	18	21.5	0.0	May 1	21.2	1.3
25	19.1	1.3	6	20.7	0.8	19	21.5	-0.1	2	21.2	1.4
			7	20.8	0.7	20	21.5	0.3	3	21.1	1.4
26	19.2	+1.3	8	20.9	+0.7	21	21.5	-0.4	4	21.0	-1.5
27	19.4	1.3	9	20.9	0.6	22	21.5	0.5	5	20.9	1.6
28	19.5	1.2	10	21.0	0.6	23	21.5	0.5	6	20.9	1.7
29	19.7	1.2	11	21.1	0.5	24	21.5	0.6	7	20.8	1.7
30	19.8	1.2	12	21.2	0.5	25	21.5	0.7	8	20.7	1.8
31	19.9	+1.1	13	21.2	+0.4	26	21.5	-0.8	9	20.6	-1.9
Apr. 1	20.0	1.1	14	21.3	0.4	27	21.4	0.9	10	20.5	-2.0
2	20.2	+1.0	15	21.4	+0.3	28	21.4	-1.0	..	..	..

Apparent distance of satellite is $F \frac{a}{\Delta}$ Position angle of satellite is $p_1 + p_2$

Jupiter is in opposition January 20, but at this date the Earth is very near the planes of the orbits of the satellites, and hence the apparent orbits approximate straight lines.

NAME		MEAN SYNODIC PERIOD					NAME	SIDEREAL PERIOD
		d	h	m	s	d		d
V		0	11	57	27.619	=	0.498 236 33	253
I	Io	1	18	28	35.946	=	1.769 860 49	631
II	Europa	3	13	17	53.736	=	3.554 094 17	692
III	Ganymede	7	03	59	35.856	=	7.166 387 22	735
IV	Callisto	16	18	05	06.916	=	16.753 552 27	758
VI								266.00
VII								276.67

SATELLITE V

UNIVERSAL TIME OF EVERY TWENTIETH GREATEST ELONGATION

Eastern Elongation					Western Elongation								
	d	h		d	h		d	h		d	h		
Jan.	0	07.4	Mar.	30	23.3	Jan.	0	13.3	Mar.	31	05.3		
	10	06.4		Apr.	9		22.5	10		12.4	Apr.	10	04.5
	20	05.5		19	21.7		20	11.5		20	03.6		
	30	04.6		29	20.8		30	10.6		30	02.8		
Feb.	9	03.7	May	9	20.0	Feb.	9	09.7	May	10	02.0		
	19	02.8		19	19.2		19	08.8		20	01.2		
Mar.	1	01.9		29	18.4	Mar.	1	07.9		30	00.4		
	11	01.0	June	8	17.6		11	07.0	June	8	23.6		
	21	00.2		..	..		21	06.2		..	..

MULTIPLES OF THE MEAN SYNODIC PERIOD

	d	h		d	h		d	h		d	h		
1	..	0	12.0	6	..	2	23.7	11	..	5	11.5		
2	..	0	23.9	7	..	3	11.7	12	..	5	23.5		
3	..	1	11.9	8	..	3	23.7	13	..	6	11.4		
4	..	1	23.8	9	..	4	11.6	14	..	6	23.4		
5	..	2	11.8	10	..	4	23.6	15	..	7	11.4		
										16	..	7	23.3
										17	..	8	11.3
										18	..	8	23.2
										19	..	9	11.2
										20	..	9	23.2

DIFFERENTIAL COORDINATES OF SATELLITE VI FOR 0^h U.T.

Date	$\alpha_{VI}-\alpha_{Jup.}$	$\delta_{VI}-\delta_{Jup.}$	Date	$\alpha_{VI}-\alpha_{Jup.}$	$\delta_{VI}-\delta_{Jup.}$	Date	$\alpha_{VI}-\alpha_{Jup.}$	$\delta_{VI}-\delta_{Jup.}$
Jan. -2	m s -2 43	' - 4.9	Apr. 8	m s +4 00	' +20.1	Sept. 27	m s -1 41	' +10.2
2	2 26	3.4	12	3 59	19.6	Oct. 1	1 31	11.5
6	2 06	1.9	16	3 56	18.9	5	1 20	12.7
10	1 45	- 0.3	20	3 51	18.0	9	1 08	13.7
14	1 22	+ 1.3	24	3 46	17.0	13	0 56	14.8
18	-0 58	+ 3.0	28	+3 39	+15.9	17	-0 43	+15.7
22	0 33	4.6	May 2	3 31	14.7	21	0 30	16.5
26	-0 08	6.2	6	3 21	13.4	25	0 16	17.2
30	+0 17	7.8	10	3 11	12.1	29	-0 02	17.8
Feb. 3	0 42	9.4	14	3 00	10.6	Nov. 2	+0 12	18.3
7	+1 06	+10.9	18	+2 47	+ 9.1	6	+0 26	+18.6
11	1 29	12.3	22	2 34	7.5	10	0 41	18.8
15	1 51	13.7	26	2 19	5.8	14	0 56	18.9
19	2 11	15.0	30	2 04	4.2	18	1 11	18.9
23	2 30	16.2	June 3	1 48	2.5	22	1 27	18.7
27	+2 47	+17.2	7	+1 31	+ 0.8	26	+1 42	+18.4
Mar. 3	3 03	18.2	11	1 14	- 0.8	30	1 57	17.9
7	3 16	19.0	15	0 56	2.4	Dec. 4	2 12	17.3
11	3 28	19.7	19	0 38	3.9	8	2 27	16.5
15	3 38	20.2	23	0 19	5.3	12	2 41	15.5
19	+3 46	+20.6	27	+0 01	- 6.5	16	+2 55	+14.5
23	3 52	20.9	July 1	-0 18	- 7.6	20	3 08	13.2
27	3 56	20.9	Sept 19	-2 00	+ 7.5	24	3 21	11.9
31	3 59	20.8	23	-1 51	+ 8.9	28	3 32	10.4
Apr. 4	+4 01	+20.6				32	+3 43	+ 8.8

DIFFERENTIAL COORDINATES OF SATELLITE VII FOR 0^h U.T.

Date	$\alpha_{VII}-\alpha_{Jup.}$	$\delta_{VII}-\delta_{Jup.}$	Date	$\alpha_{VII}-\alpha_{Jup.}$	$\delta_{VII}-\delta_{Jup.}$	Date	$\alpha_{VII}-\alpha_{Jup.}$	$\delta_{VII}-\delta_{Jup.}$
Jan. -2	m s -4 26	' -20.4	Apr. 8	m s +3 05	' + 7.1	Sept. 27	m s -3 17	' -8.6
2	4 13	21.5	12	3 00	9.0	Oct. 1	3 12	8.6
6	3 58	22.4	16	2 52	10.7	5	3 05	8.6
10	3 40	23.2	20	2 42	12.1	9	2 58	8.4
14	3 21	23.8	24	2 30	13.3	13	2 50	8.2
18	-2 59	-24.1	28	+2 15	+14.2	17	-2 41	-7.9
22	2 36	24.3	May 2	2 00	14.8	21	2 30	7.6
26	2 11	24.2	6	1 43	15.2	25	2 19	7.2
30	1 46	23.9	10	1 26	15.4	29	2 06	6.8
Feb. 3	1 20	23.4	14	1 08	15.3	Nov. 2	1 52	6.3
7	-0 53	-22.6	18	+0 50	+15.1	6	-1 38	-5.8
11	0 27	21.7	22	0 33	14.7	10	1 22	5.2
15	-0 01	20.5	26	+0 15	14.2	14	1 04	4.6
19	+0 25	19.2	30	-0 02	13.5	18	0 46	4.0
23	0 49	17.6	June 3	0 19	12.8	22	0 27	3.3
27	+1 13	-15.8	7	-0 36	+11.9	26	-0 06	-2.6
Mar. 3	1 35	13.8	11	0 52	11.0	30	+0 15	1.8
7	1 55	11.7	15	1 07	10.0	Dec. 4	0 37	1.0
11	2 13	9.5	19	1 21	9.0	8	0 59	-0.2
15	2 28	7.1	23	1 35	7.9	12	1 21	+0.6
19	+2 42	- 4.6	27	-1 48	+ 6.8	16	+1 42	+1.4
23	2 52	- 2.1	July 1	-2 00	+ 5.8	20	2 02	2.2
27	3 00	+ 0.3	Sept. 19	-3 24	- 8.4	24	2 21	2.9
31	3 05	2.7	23	-3 21	- 8.6	28	2 38	3.6
Apr. 4	+3 06	+ 5.0				32	+2 52	+4.3

UNIVERSAL TIME OF SUPERIOR GEOCENTRIC CONJUNCTION

SATELLITE I

	d	h	m		d	h	m		d	h	m		d	h	m
Jan.	0	03	11	Mar.	22	11	32	June	10	03	24	Oct.	15	15	28
	1	21	37		24	06	00		11	21	55		17	09	58
	3	16	03		26	00	28		13	16	25		19	04	27
	5	10	29		27	18	56		15	10	55		20	22	56
	7	04	55		29	13	24		17	05	25		22	17	26
	8	23	21		31	07	52		18	23	55		24	11	55
	10	17	47	Apr.	2	02	20		20	18	25		26	06	24
	12	12	13		3	20	49		22	12	55		28	00	53
	14	06	39		5	15	17		24	07	25		29	19	23
	16	01	05		7	09	46		26	01	55		31	13	52
	17	19	31		9	04	14		27	20	26	Nov.	2	08	21
	19	13	57		10	22	43		29	14	56		4	02	50
	21	08	23		12	17	12	July	1	09	26		5	21	19
	23	02	49		14	11	40		3	03	56		7	15	48
	24	21	15		16	06	08		4	22	26		9	10	16
	26	15	40		18	00	38		6	16	57		11	04	45
	28	10	07		19	19	07		8	11	27		12	23	14
	30	04	33		21	13	36		...	...	...		14	17	43
	31	22	59		23	08	04	Aug.	27	01	33		16	12	11
Feb.	2	17	25		25	02	34		28	20	03		18	06	40
	4	11	51		26	21	04		30	14	33		20	01	08
	6	06	17		28	15	32	Sept.	1	09	03		21	19	37
	8	00	44		30	10	01		3	03	33		23	14	05
	9	19	09	May	2	04	31		4	22	03		25	08	34
	11	13	36		3	23	00		6	16	33		27	03	02
	13	08	03		5	17	29		8	11	03		28	21	30
	15	02	29		7	11	59		10	05	33		30	15	59
	16	20	55		9	06	28		12	00	03	Dec.	2	10	27
	18	15	22		11	00	58		13	18	33		4	04	55
	20	09	49		12	19	27		15	13	03		5	23	23
	22	04	15		14	13	57		17	07	33		7	17	51
	23	22	42		16	08	27		19	02	03		9	12	19
	25	17	09		18	02	56		20	20	33		11	06	46
	27	11	36		19	21	26		22	15	03		13	01	14
Mar.	1	06	03		21	15	56		24	09	33		14	19	42
	3	00	30		23	10	25		26	04	02		16	14	09
	4	18	57		25	04	55		27	22	32		18	08	37
	6	13	24		26	23	25		29	17	02		20	03	04
	8	07	51		28	17	55	Oct.	1	11	32		21	21	32
	10	02	19		30	12	25		3	06	01		23	15	59
	11	20	46	June	1	06	55		5	00	31		25	10	26
	13	15	13		3	01	25		6	19	01		27	04	54
	15	09	41		4	19	55		8	13	30		28	23	21
	17	04	09		6	14	24		10	08	00		30	17	48
	18	22	36		8	08	55		12	02	29		32	12	15
	20	17	04						13	20	59				

UNIVERSAL TIME OF SUPERIOR GEOCENTRIC CONJUNCTION

SATELLITE II

	d	h	m		d	h	m		d	h	m		d	h	m
Jan.	0	22	18	Mar.	23	12	38	June	13	07	08	Oct.	15	20	36
	4	11	25		27	01	52		16	20	32		19	09	58
	8	00	32		30	15	07		20	09	56		22	23	20
	11	13	38	Apr.	3	04	22		23	23	20		26	12	42
	15	02	45		6	17	38		27	12	45		30	02	03
	18	15	51		10	06	54	July	1	02	10	Nov.	2	15	24
	22	04	58		13	20	12		4	15	34		6	04	44
	25	18	04		17	09	29		8	05	00		9	18	04
	29	07	11		20	22	47		..	..	..		13	07	24
Feb.	1	20	17		24	12	06	Aug.	27	00	56		16	20	43
	5	09	25		28	01	25		30	14	21		20	10	01
	8	22	32	May	1	14	44	Sept.	3	03	47		23	23	19
	12	11	40		5	04	04		6	17	12		27	12	37
	16	00	48		8	17	25		10	06	37	Dec.	1	01	54
	19	13	56		12	06	45		13	20	01		4	15	10
	23	03	05		15	20	07		17	09	27		8	04	26
Mar.	26	16	15		19	09	28		20	22	51		11	17	41
	2	05	25		22	22	50		24	12	15		15	06	56
	5	18	36		26	12	12		28	01	39		18	20	10
	9	07	47		30	01	35	Oct.	1	15	03		22	09	24
	12	20	59	June	2	14	58		5	04	26		25	22	36
	16	10	11		6	04	21		8	17	50		29	11	49
	19	23	24		9	17	44		12	07	13				

SATELLITE III

	d	h	m		d	h	m		d	h	m		d	h	m
Jan.	4	07	26	Mar.	31	00	45	June	17	22	29	Oct.	18	01	26
	11	10	43	Apr.	7	04	37		25	02	53		25	05	41
	18	13	59		14	08	33	July	2	07	17	Nov.	1	09	53
	25	17	14		21	12	34		..	..	..		8	14	02
Feb.	1	20	31		28	16	39	Aug.	28	18	52		15	18	08
	8	23	48	May	5	20	47		4	23	18		22	22	10
	16	03	09		13	00	58	Sept.	12	03	43		30	02	07
	23	06	34		20	05	11		19	08	07	Dec.	7	06	00
Mar.	2	10	03		27	09	27		26	12	30		14	09	49
	9	13	37	June	3	13	46	Oct.	3	16	51		21	13	34
	16	17	15		10	18	06		10	21	10		28	17	14
	23	20	58												

SATELLITE IV

	d	h	m		d	h	m		d	h	m		d	h	m
Jan.	7	00	09	Mar.	31	03	28	June	23	02	42	Oct.	19	01	53
	23	14	13	Apr.	16	21	06		..	..	..	Nov.	4	21	13
Feb.	9	04	24	May	3	15	35	Aug.	29	13	12		21	15	52
	25	19	10		20	10	47	Sept.	15	09	44	Dec.	8	09	41
Mar.	14	10	49	June	6	06	32	Oct.	2	06	00		25	02	31

UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

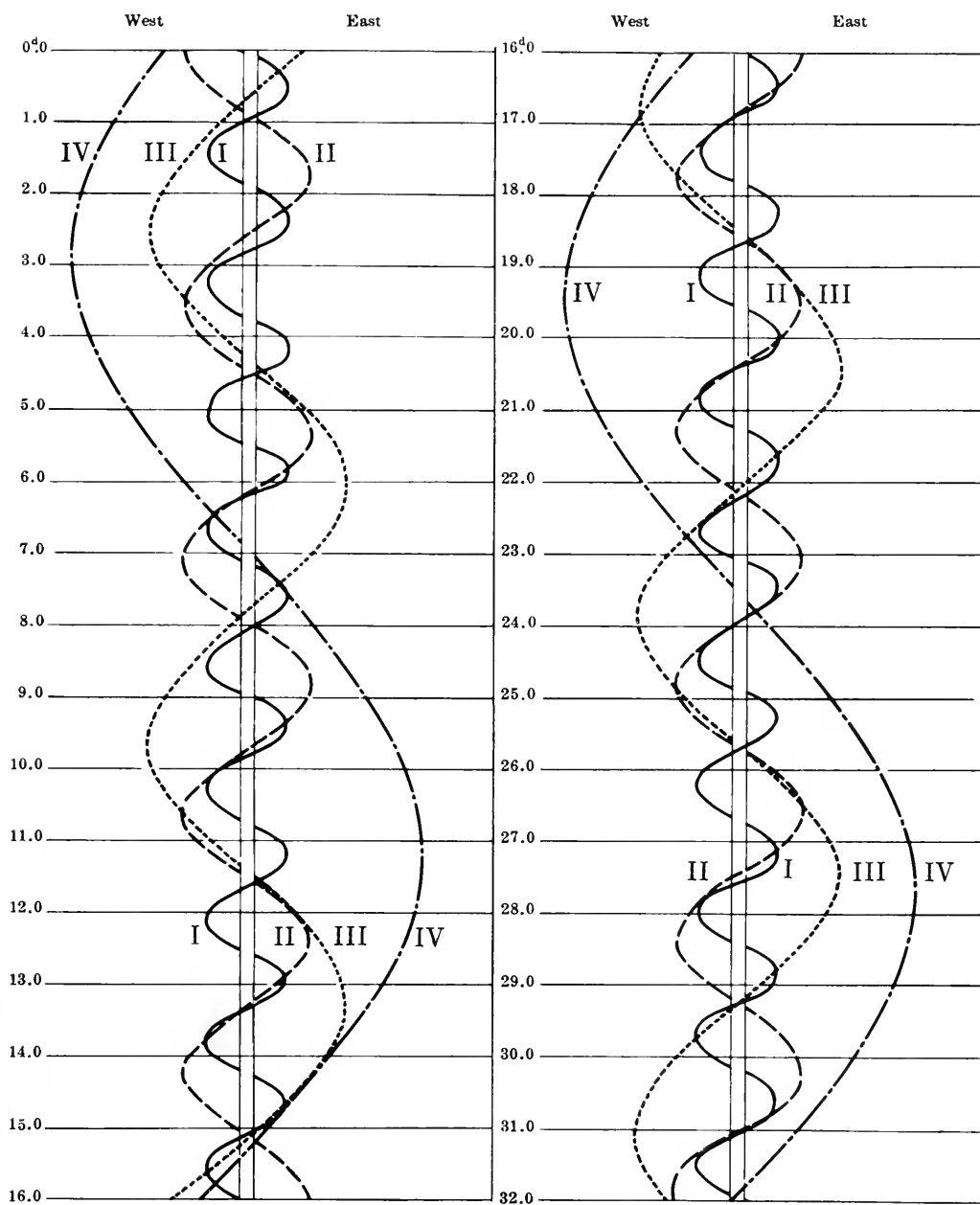
JANUARY

d	h	m		d	h	m		d	h	m		d	h	m	
0	1	32	I. Ec.D.	8	0	43	I. Sh.I.	15	23	50	I. Ec.D.	24	0	55	II. Tr.E.
	4	20	I. Oc.R.		1	01	I. Tr.I.						1	07	II. Sh.E.
	14	03	III. Sh.I.		1	58	II. Oc.R.	16	2	14	I. Oc.R.		1	11	I. Tr.E.
	15	59	III. Tr.I.		3	00	I. Sh.E.		19	35	II. Sh.I.		1	16	I. Sh.E.
	17	35	III. Sh.E.		3	18	I. Tr.E.		19	45	II. Tr.I.		20	06	I. Oc.D.
	19	32	III. Tr.E.		21	55	I. Ec.D.		21	06	I. Sh.I.		22	31	I. Ec.R.
	19	56	II. Ec.D.						21	11	I. Tr.I.				
	22	50	I. Sh.I.	9	0	30	I. Oc.R.		22	29	II. Sh.E.	25	15	27	III. Oc.D.
	23	18	I. Tr.I.		16	58	II. Sh.I.		22	40	II. Tr.E.		16	38	II. Oc.D.
	23	44	II. Oc.R.		17	30	II. Tr.I.		23	22	I. Sh.E.		17	20	I. Tr.I.
					19	12	I. Sh.I.		23	27	I. Tr.E.		17	28	I. Sh.I.
1	1	06	I. Sh.E.		19	27	I. Tr.I.						19	35	III. Ec.R.
	1	34	I. Tr.E.		19	52	II. Sh.E.	17	18	18	I. Ec.D.		19	36	I. Tr.E.
	20	01	I. Ec.D.		20	25	II. Tr.E.		20	40	I. Oc.R.		19	45	I. Sh.E.
	22	46	I. Oc.R.		21	28	I. Sh.E.						19	46	II. Ec.R.
					21	44	I. Tr.E.								
2	14	21	II. Sh.I.					18	12	02	III. Ec.D.	26	14	32	I. Oc.D.
	15	14	II. Tr.I.	10	16	24	I. Ec.D.		14	21	II. Ec.D.		16	59	I. Ec.R.
	17	15	II. Sh.E.		18	57	I. Oc.R.		15	34	I. Sh.I.				
	17	18	I. Sh.I.						15	36	I. Tr.I.				
	17	44	I. Tr.I.						15	46	III. Oc.R.	27	11	09	II. Tr.I.
	18	09	II. Tr.E.	11	8	02	III. Ec.D.		17	17	II. Oc.R.		11	31	II. Sh.I.
	19	35	I. Sh.E.		11	47	II. Ec.D.		17	51	I. Sh.E.		11	46	I. Tr.I.
	20	00	I. Tr.E.		12	30	III. Oc.R.		17	53	I. Tr.E.		11	57	I. Sh.I.
					13	40	I. Sh.I.						14	02	I. Tr.E.
3	14	29	I. Ec.D.		13	53	I. Tr.I.	19	12	47	I. Ec.D.		14	03	II. Tr.E.
	17	13	I. Oc.R.		15	04	II. Oc.R.		15	05	I. Oc.R.		14	13	I. Sh.E.
					15	57	I. Sh.E.						14	26	II. Sh.E.
					16	10	I. Tr.E.								
4	4	03	III. Ec.D.					20	8	53	II. Tr.I.	28	8	58	I. Oc.D.
	9	13	II. Ec.D.	12	10	52	I. Ec.D.		8	54	II. Sh.I.		11	28	I. Ec.R.
	9	13	III. Oc.R.		13	22	I. Oc.R.		10	02	I. Tr.I.				
	11	47	I. Sh.I.						10	03	I. Sh.I.	29	5	02	III. Tr.I.
	12	10	I. Tr.I.	13	6	17	II. Sh.I.		11	48	II. Tr.E.		5	45	II. Oc.D.
	12	51	II. Oc.R.		6	38	II. Tr.I.		11	49	II. Sh.E.		5	58	III. Sh.I.
	14	03	I. Sh.E.		8	09	I. Sh.I.		12	19	I. Tr.E.		6	12	I. Tr.I.
	14	26	I. Tr.E.		8	19	I. Tr.I.		12	19	I. Sh.E.		6	25	I. Sh.I.
5	8	58	I. Ec.D.		9	11	II. Sh.E.	21	7	14	I. Oc.D.		8	28	I. Tr.E.
	11	38	I. Oc.R.		9	33	II. Tr.E.		9	34	I. Ec.R.		8	35	III. Tr.E.
					10	25	I. Sh.E.						8	42	I. Sh.E.
					10	36	I. Tr.E.						9	04	II. Ec.R.
6	3	40	II. Sh.I.					22	1	46	III. Tr.I.	30	3	24	I. Oc.D.
	4	23	II. Tr.I.						1	59	III. Sh.I.		5	57	I. Ec.R.
	6	15	I. Sh.I.	14	5	21	I. Ec.D.		3	32	II. Oc.D.				
	6	34	II. Sh.E.		7	48	I. Oc.R.		4	28	I. Tr.I.				
	6	36	I. Tr.I.		22	00	III. Sh.I.		4	31	I. Sh.I.				
	7	17	II. Tr.E.		22	32	III. Tr.I.		5	20	III. Tr.E.	31	0	16	II. Tr.I.
	8	32	I. Sh.E.						5	31	III. Sh.E.		0	38	I. Tr.I.
	8	52	I. Tr.E.	15	1	04	II. Ec.D.		6	29	II. Ec.R.		0	49	II. Sh.I.
	18	50	IV. Ec.D.		1	32	III. Sh.E.		6	45	I. Tr.E.		0	54	I. Sh.I.
					2	05	III. Tr.E.		6	48	I. Sh.E.		2	54	I. Tr.E.
					2	37	I. Sh.I.						3	10	I. Sh.E.
7	2	22	IV. Oc.R.		2	45	I. Tr.I.	23	1	40	I. Oc.D.		3	10	II. Tr.E.
	3	27	I. Ec.D.		4	11	II. Oc.R.		4	02	I. Ec.R.		3	10	II. Sh.E.
	6	04	I. Oc.R.		4	51	IV. Sh.I.		12	00	IV. Oc.D.		3	44	IV. Tr.I.
	18	02	III. Sh.I.		4	54	I. Sh.E.		17	13	IV. Ec.R.		20	06	I. Oc.D.
	19	16	III. Tr.I.		5	01	I. Tr.E.		22	00	II. Tr.I.		21	50	I. Oc.D.
	21	34	III. Sh.E.		5	57	IV. Tr.I.		22	12	II. Sh.I.		22	50	IV. Sh.I.
	22	30	II. Ec.D.		9	06	IV. Sh.E.		22	54	I. Tr.I.				
	22	50	III. Tr.E.		10	18	IV. Tr.E.		23	00	I. Sh.I.				





I. Jan. 15	II. Jan. 15	III. Jan. 18	IV. Jan. 23
$x_1 = -1.1, y_1 = +0.1$	$x_1 = -1.2, y_1 = +0.1$	$x_1 = -1.1, y_1 = +0.2$	$x_2 = +1.2, y_2 = +0.4$

NOTE.—I, denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR JANUARY
UNIVERSAL TIME

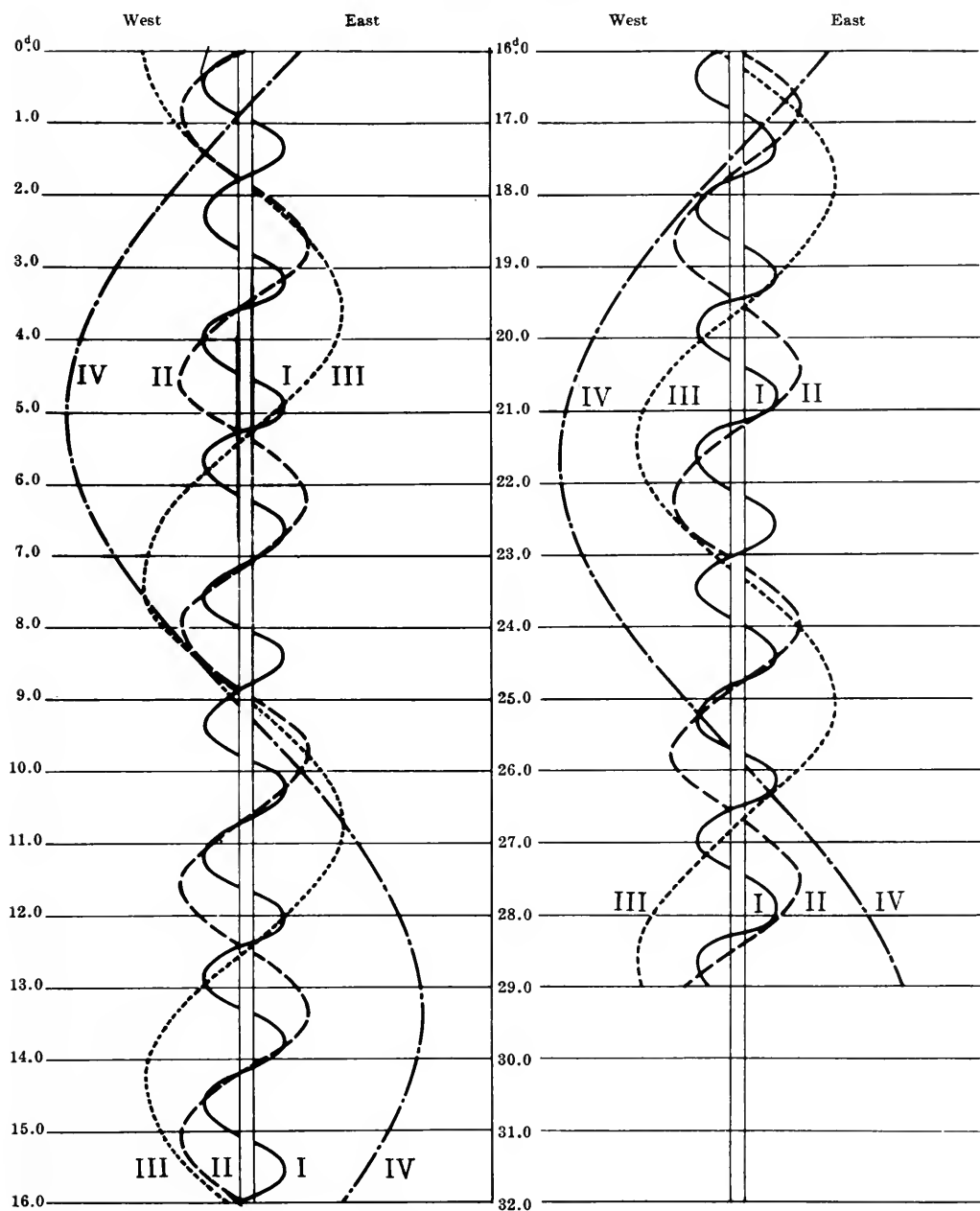


PHASES OF THE ECLIPSES

<p>I</p> <p>W</p> 	<p>III</p> <p>E W</p>  <p>E</p>
<p>II</p> <p>W</p> 	<p>IV</p> <p>E W</p>  <p>E</p>

UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

CONFIGURATIONS OF SATELLITES I-IV FOR FEBRUARY
UNIVERSAL TIME



PHASES OF THE ECLIPSES

I			III		
W		E	W		E
II			IV		
W		E	W		E

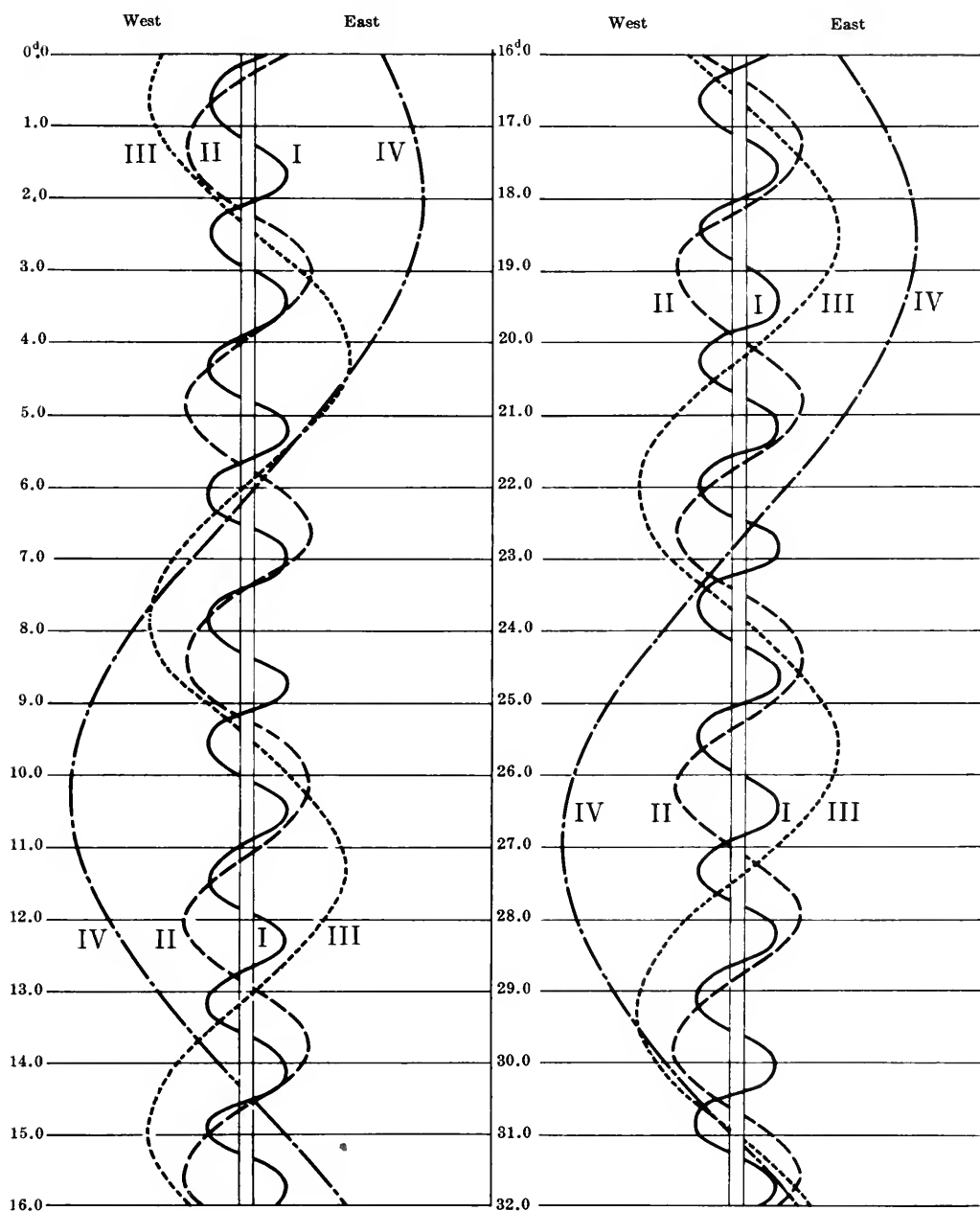
UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

MARCH

d	h	m		d	h	m		d	h	m		d	h	m	
1	4	54	I. Oc.D.	9	4	55	I. Sh.I.	16	13	50	II. Ec.R.	24	3	35	III. Ec.R.
	8	06	I. Ec.R.		6	10	I. Tr.E.		15	29	III. Oc.D.		4	51	I. Oc.D.
					6	21	II. Oc.D.		19	02	III. Oc.R.		8	21	I. Ec.R.
2	2	06	I. Tr.I.		7	11	I. Sh.E.		19	59	III. Ec.D.				
	3	00	I. Sh.I.		11	14	II. Ec.R.		23	35	III. Ec.R.	25	2	03	I. Tr.I.
	3	59	II. Oc.D.		11	51	III. Oc.D.						3	13	I. Sh.I.
	4	22	I. Tr.E.		15	24	III. Oc.R.	17	3	00	I. Oc.D.		4	18	I. Tr.E.
	5	16	I. Sh.E.		15	59	III. Ec.D.		6	26	I. Ec.R.		5	29	I. Sh.E.
	8	16	III. Oc.D.		19	35	III. Ec.R.						6	06	II. Tr.I.
	8	39	II. Ec.R.					18	0	12	I. Tr.I.		8	32	II. Sh.I.
	11	50	III. Oc.R.	10	1	10	I. Oc.D.		1	18	I. Sh.I.		8	59	II. Tr.E.
	11	58	III. Ec.D.		4	30	I. Ec.R.		2	27	I. Tr.E.		11	25	II. Sh.E.
	15	34	III. Ec.R.		22	22	I. Tr.I.		3	34	I. Sh.E.		23	19	I. Oc.D.
	23	21	I. Oc.D.		23	23	I. Sh.I.		3	37	II. Tr.I.				
									5	54	II. Sh.I.	26	2	49	I. Ec.R.
3	2	35	I. Ec.R.	11	0	38	I. Tr.E.		6	30	II. Tr.E.		20	30	I. Tr.I.
	20	33	I. Tr.I.		1	09	II. Tr.I.		8	48	II. Sh.E.		21	42	I. Sh.I.
	21	29	I. Sh.I.		1	39	I. Sh.E.		21	28	I. Oc.D.		22	46	I. Tr.E.
	22	44	II. Tr.I.		3	17	II. Sh.I.						23	58	I. Sh.E.
	22	49	I. Tr.E.		4	02	II. Tr.E.	19	0	54	I. Ec.R.				
	23	45	I. Sh.E.		6	10	II. Sh.E.		18	39	I. Tr.I.	27	0	26	II. Oc.D.
4	0	39	II. Sh.I.		19	37	I. Oc.D.		19	47	I. Sh.I.		5	43	II. Ec.R.
	1	38	II. Tr.E.		22	58	I. Ec.R.		20	55	I. Tr.E.		9	00	III. Tr.I.
	3	33	II. Sh.E.	12	16	49	I. Tr.I.		21	58	II. Oc.D.		12	31	III. Tr.E.
	17	48	I. Oc.D.		17	52	I. Sh.I.		22	03	I. Sh.E.		13	52	III. Sh.I.
	21	03	I. Ec.R.		19	05	I. Tr.E.	20	3	07	II. Ec.R.		17	27	III. Sh.E.
					19	33	II. Oc.D.		5	15	III. Tr.I.		17	47	I. Oc.D.
5	15	00	I. Tr.I.		20	08	I. Sh.E.		8	46	III. Tr.E.		21	19	I. Ec.R.
	15	57	I. Sh.I.						9	53	III. Sh.I.	28	14	58	I. Tr.I.
	17	10	II. Oc.D.	13	0	32	II. Ec.R.		13	27	III. Sh.E.		16	10	I. Sh.I.
	17	16	I. Tr.E.		1	34	III. Tr.I.		15	55	I. Oc.D.		17	14	I. Tr.E.
	18	13	I. Sh.E.		5	06	III. Tr.E.		19	23	I. Ec.R.		18	26	I. Sh.E.
	21	57	II. Ec.R.		5	54	III. Sh.I.						19	22	II. Tr.I.
	21	59	III. Tr.I.		9	27	III. Sh.E.	21	13	07	I. Tr.I.		21	50	II. Sh.I.
					14	05	I. Oc.D.		14	15	I. Sh.I.		22	14	II. Tr.E.
6	1	31	III. Tr.E.		17	28	I. Ec.R.		15	23	I. Tr.E.				
	1	50	IV. Tr.I.						16	32	I. Sh.E.	29	0	43	II. Sh.E.
	1	54	III. Sh.I.	14	8	37	IV. Oc.D.		16	51	II. Tr.I.		12	15	I. Oc.D.
	5	28	III. Sh.E.		11	17	I. Tr.I.		19	13	II. Sh.I.		15	48	I. Ec.R.
	6	06	IV. Tr.E.		12	21	I. Sh.I.		19	44	II. Tr.E.				
	10	51	IV. Sh.I.		12	59	IV. Oc.R.		22	06	II. Sh.E.	30	9	27	I. Tr.I.
	12	15	I. Oc.D.		13	32	I. Tr.E.						10	39	I. Sh.I.
	15	18	IV. Sh.E.		14	22	II. Tr.I.	22	10	23	I. Oc.D.		11	42	I. Tr.E.
	15	32	I. Ec.R.		14	37	I. Sh.E.		13	52	I. Ec.R.		12	55	I. Sh.E.
7	9	27	I. Tr.I.		16	35	II. Sh.I.		18	00	IV. Tr.I.		13	41	II. Oc.D.
	10	26	I. Sh.I.		17	15	II. Tr.E.		22	16	IV. Tr.E.		19	00	II. Ec.R.
	11	43	I. Tr.E.		18	59	IV. Ec.D.						22	58	III. Oc.D.
	11	56	II. Tr.I.		19	28	II. Sh.E.	23	4	52	IV. Sh.I.				
	12	42	I. Sh.E.		23	34	IV. Ec.R.		7	35	I. Tr.I.	31	1	16	IV. Oc.D.
	13	57	II. Sh.I.						8	44	I. Sh.I.		2	32	III. Oc.R.
	14	49	II. Tr.E.	15	8	32	I. Oc.D.		9	22	IV. Sh.E.		3	58	III. Ec.D.
	16	51	II. Sh.E.		11	57	I. Ec.R.		9	50	I. Tr.E.		5	39	IV. Oc.R.
8	6	43	I. Oc.D.						11	00	I. Sh.E.		6	43	I. Oc.D.
	10	01	I. Ec.R.	16	5	44	I. Tr.I.		11	12	II. Oc.D.		7	34	III. Ec.R.
					6	49	I. Sh.I.		16	25	II. Ec.R.		10	16	I. Ec.R.
					8	00	I. Tr.E.		19	11	III. Oc.D.		13	03	IV. Ec.D.
					8	45	II. Oc.D.		22	45	III. Oc.R.		17	41	IV. Ec.R.
9	3	55	I. Tr.I.		9	05	I. Sh.E.		23	58	III. Ec.D.				
I. Mar. 17				II. Mar. 16				III. Mar. 16				IV. Mar. 14			
$x_2=+1.9, y_2=+0.1$				$x_2=+2.5, y_2=0.0$				$x_1=+1.5, y_1=+0.2$ $x_2=+3.4, y_2=+0.2$				$x_1=+3.3, y_1=+0.3$ $x_2=+5.2, y_2=+0.3$			

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR MARCH
UNIVERSAL TIME



PHASES OF THE ECLIPSES

I		r		III		d	r	
W		•	E	W		•	•	E
II		r		IV		d	r	
W		•	E	W		•	•	E

UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

APRIL

d 1 3 55 5 08 6 10 7 24 8 38 11 09 11 31 14 02	 I. Tr.I. I. Sh.I. I. Tr.E. I. Sh.E. II. Tr.I. II. Sh.I. II. Tr.E. II. Sh.E.	d 2 1 12 4 45 22 23 23 36	 I. Oc.D. I. Ec.R. I. Tr.I. I. Sh.I.	d 3 0 38 1 53 2 56 8 18 12 50 16 21 17 53 19 40 21 27 23 14	 I. Tr.E. I. Sh.E. II. Oc.D. II. Ec.R. III. Tr.I. III. Tr.E. III. Sh.I. I. Oc.D. III. Sh.E. I. Ec.R.	d 4 16 51 18 05 19 07 20 21 21 55	 I. Tr.I. I. Sh.I. I. Tr.E. I. Sh.E. II. Tr.I.	d 5 0 28 0 47 3 21 14 08 17 43	 II. Sh.I. II. Tr.E. II. Sh.E. I. Oc.D. I. Ec.R.	d 6 11 19 12 34 13 35 14 50 16 12 21 36	 I. Tr.I. I. Sh.I. I. Tr.E. I. Sh.E. II. Oc.D. II. Ec.R.	d 7 2 50 6 24 7 57 8 37 11 34 12 12	 III. Oc.D. III. Oc.R. III. Ec.D. I. Oc.D. III. Ec.R. I. Ec.R.	d 8 5 48 7 03 8 04 9 19 11 08 11 12	 I. Tr.I. I. Sh.I. I. Tr.E. I. Sh.E. IV. Tr.I. II. Tr.I.	d 9 3 05 3 27 6 40	 I. Oc.D. IV. Sh.E. I. Ec.R.	d 10 0 16 1 31 2 32 3 48 5 28 10 54 16 44 20 15 21 34 21 52	 I. Tr.I. I. Sh.I. I. Tr.E. I. Sh.E. II. Oc.D. II. Ec.R. III. Tr.I. III. Tr.E. I. Oc.D. III. Sh.I.	d 11 1 09 1 27 18 45 20 00 21 01 22 16	 I. Ec.R. III. Sh.E. I. Tr.I. I. Sh.I. I. Tr.E. I. Sh.E.	d 12 0 30 3 05 3 22 5 58 16 03 19 38	 II. Tr.I. II. Sh.I. II. Tr.E. II. Sh.E. I. Oc.D. I. Ec.R.	d 13 13 13 14 29 15 29 16 45 18 45	 I. Tr.I. I. Sh.I. I. Tr.E. I. Sh.E. II. Oc.D.	d 14 0 12 6 46 10 20 10 31 11 58 14 07 15 35	 II. Ec.R. III. Oc.D. III. Oc.R. I. Oc.D. III. Sh.E. I. Ec.R. III. Ec.R.	d 15 7 42 8 58 9 58 11 14 13 49 16 24 16 41 19 17	 I. Tr.I. I. Sh.I. I. Tr.E. I. Sh.E. II. Tr.I. II. Sh.I. II. Tr.E. II. Sh.E.	d 16 5 00 8 36 18 53 23 17	 I. Oc.D. I. Ec.R. IV. Oc.D. IV. Oc.R.	d 17 2 11 3 26 4 27 5 43 7 06 8 03 11 48 13 30 20 42 23 29	 I. Tr.I. I. Sh.I. I. Tr.E. I. Sh.E. IV. Ec.D. II. Oc.D. IV. Ec.R. II. Ec.R. III. Tr.I. I. Oc.D.	d 18 0 14 1 52 3 05 5 27 20 40 21 55 22 55	 III. Tr.E. III. Sh.I. I. Ec.R. III. Sh.E. I. Tr.I. I. Sh.I. I. Tr.E.	d 19 0 11 3 07 5 42 5 59 8 35 17 58 21 34	 I. Sh.E. II. Tr.I. II. Sh.I. II. Tr.E. II. Sh.E. I. Oc.D. I. Ec.R.	d 20 15 08 16 24 17 24 18 40 21 21	 I. Tr.I. I. Sh.I. I. Tr.E. I. Sh.E. II. Oc.D.	d 21 2 48 10 47 12 27 14 21 15 58 16 02 19 35	 II. Ec.R. III. Oc.D. I. Oc.D. III. Oc.R. III. Ec.D. I. Ec.R. III. Ec.R.	d 22 9 37 10 53 11 53 13 09 16 27 19 01 19 19 21 54	 I. Tr.I. I. Sh.I. I. Tr.E. I. Sh.E. II. Tr.I. II. Sh.I. II. Tr.E. II. Sh.E.	d 23 6 55 10 31	 I. Oc.D. I. Ec.R.	d 24 4 06 5 21 6 22 7 38 10 40 16 05	 I. Tr.I. I. Sh.I. I. Tr.E. I. Sh.E. II. Oc.D. II. Ec.R.	d 25 0 44 1 25 4 16 5 00 5 09 5 52 9 27 9 29 16 55 21 31 22 35 23 50	 III. Tr.I. I. Oc.D. III. Tr.E. I. Ec.R. IV. Tr.I. III. Sh.I. III. Sh.E. IV. Tr.E. IV. Sh.I. IV. Sh.E. I. Tr.I. I. Sh.I.	d 26 0 51 2 07 5 46 8 19 8 38 11 12 19 55 23 29	 I. Tr.E. I. Sh.E. II. Tr.I. II. Sh.I. II. Tr.E. II. Sh.E. I. Oc.D. I. Ec.R.	d 27 17 04 18 19 19 20 20 35 23 59	 I. Tr.I. I. Sh.I. I. Tr.E. I. Sh.E. II. Oc.D.	d 28 5 24 14 23 14 52 17 58 18 26 19 58 23 36	 II. Ec.R. I. Oc.D. III. Oc.D. I. Ec.R. III. Oc.R. III. Ec.D. III. Ec.R.	d 29 11 33 12 48 13 49 15 04 19 06 21 38 21 58	 I. Tr.I. I. Sh.I. I. Tr.E. I. Sh.E. II. Tr.I. II. Sh.I. II. Tr.E.	d 30 0 30 8 52 12 26	 II. Sh.E. I. Oc.D. I. Ec.R.
I. Apr. 16 $x_2=+2.1, \quad y_2=+0.1$				II. Apr. 17 $x_2=+2.8, \quad y_2=0.0$				III. Apr. 14 $x_1=+1.9, \quad y_1=+0.1$ $x_2=+3.8, \quad y_2=+0.1$				IV. Apr. 17 $x_1=+4.1, \quad y_1=+0.3$ $x_2=+5.9, \quad y_2=+0.3$																																															

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

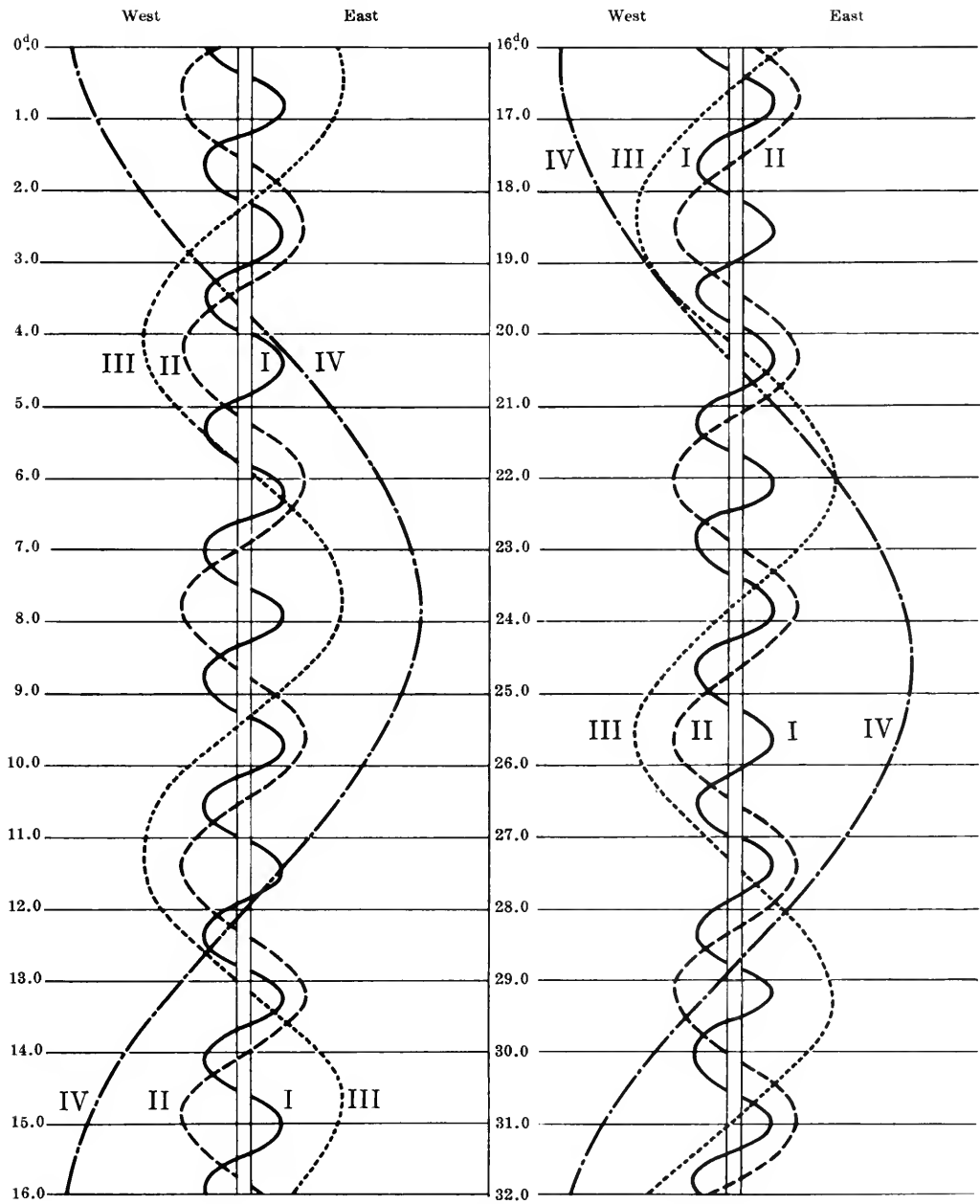
UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

MAY





d	h	m		d	h	m		d	h	m		d	h	m	
1	6	03	I. Tr.I.	9	5	19	I. Oc.D.	17	4	27	I. Tr.I.	24	19	28	II. Tr.E.
	7	16	I. Sh.I.		8	50	I. Ec.R.		5	35	I. Sh.I.		21	38	II. Sh.E.
	8	18	I. Tr.E.		8	58	III. Tr.I.		6	43	I. Tr.E.				
	9	33	I. Sh.E.		12	31	III. Tr.E.		7	52	I. Sh.E.	25	3	46	I. Oc.D.
	13	18	II. Oc.D.		13	51	III. Sh.I.		13	51	II. Tr.I.		7	09	I. Ec.R.
	18	42	II. Ec.R.		17	27	III. Sh.E.		16	09	II. Sh.I.				
									16	44	II. Tr.E.	26	0	55	I. Tr.I.
2	3	22	I. Oc.D.	10	2	29	I. Tr.I.		19	02	II. Sh.E.		1	59	I. Sh.I.
	4	49	III. Tr.I.		3	40	I. Sh.I.						3	12	I. Tr.E.
	6	55	I. Ec.R.		4	45	I. Tr.E.	18	1	48	I. Oc.D.		4	16	I. Sh.E.
	8	22	III. Tr.E.		5	57	I. Sh.E.		5	14	I. Ec.R.		10	46	II. Oc.D.
	9	51	III. Sh.I.		11	08	II. Tr.I.		22	57	I. Tr.I.		15	49	II. Ec.R.
	13	27	III. Sh.E.		13	33	II. Sh.I.						22	16	I. Oc.D.
					14	00	II. Tr.E.	19	0	04	I. Sh.I.	27	1	38	I. Ec.R.
3	0	32	I. Tr.I.		16	25	II. Sh.E.		1	13	I. Tr.E.		7	39	III. Oc.D.
	1	45	I. Sh.I.		23	49	I. Oc.D.		2	21	I. Sh.E.		11	15	III. Oc.R.
	2	48	I. Tr.E.						8	02	II. Oc.D.		11	56	III. Ec.D.
	4	02	I. Sh.E.	11	3	19	I. Ec.R.		13	12	II. Ec.R.		15	34	III. Ec.R.
	8	26	II. Tr.I.		20	58	I. Tr.I.		20	17	I. Oc.D.		19	25	I. Tr.I.
	10	56	II. Sh.I.		22	09	I. Sh.I.		23	43	I. Ec.R.		20	28	I. Sh.I.
	11	19	II. Tr.E.		23	15	I. Tr.E.	20	3	23	III. Oc.D.		21	42	I. Tr.E.
	13	20	IV. Oc.D.		23	55	IV. Tr.I.		6	59	III. Oc.R.		22	45	I. Sh.E.
	13	49	II. Sh.E.	12	0	26	I. Sh.E.		7	57	III. Ec.D.	28	5	58	II. Tr.I.
	17	48	IV. Oc.R.		4	19	IV. Tr.E.		8	30	IV. Oc.D.		8	04	II. Sh.I.
	21	52	I. Oc.D.		5	19	II. Oc.D.		11	35	III. Ec.R.		8	50	II. Tr.E.
4	1	10	IV. Ec.D.		10	36	II. Ec.R.		13	03	IV. Oc.R.		10	56	II. Sh.E.
	1	24	I. Ec.R.		10	56	IV. Sh.I.		17	26	I. Tr.I.		16	46	I. Oc.D.
	5	55	IV. Ec.R.		15	35	IV. Sh.E.		18	33	I. Sh.I.		19	18	IV. Tr.I.
	19	01	I. Tr.I.		18	19	I. Oc.D.		19	14	IV. Ec.D.		20	07	I. Ec.R.
	20	14	I. Sh.I.		21	48	I. Ec.R.		19	43	I. Tr.E.		23	47	IV. Tr.E.
	21	17	I. Tr.E.		23	10	III. Oc.D.	21	0	01	IV. Ec.R.	29	4	58	IV. Sh.I.
	22	30	I. Sh.E.	13	2	45	III. Oc.R.		3	13	II. Tr.I.		9	39	IV. Sh.E.
5	2	38	II. Oc.D.		3	57	III. Ec.D.		5	28	II. Sh.I.		13	55	I. Tr.I.
	8	00	II. Ec.R.		7	35	III. Ec.R.		6	06	II. Tr.E.		14	57	I. Sh.I.
	16	21	I. Oc.D.		15	28	I. Tr.I.		8	20	II. Sh.E.		16	12	I. Tr.E.
	18	59	III. Oc.D.		16	38	I. Sh.I.		14	47	I. Oc.D.		17	14	I. Sh.E.
	19	53	I. Ec.R.		17	44	I. Tr.E.		18	12	I. Ec.R.	30	0	08	II. Oc.D.
	22	34	III. Oc.R.		18	55	I. Sh.E.						5	07	II. Ec.R.
	23	58	III. Ec.D.					22	11	56	I. Tr.I.		11	16	I. Oc.D.
6	3	36	III. Ec.R.	14	0	30	II. Tr.I.		13	02	I. Sh.I.		14	35	I. Ec.R.
	13	30	I. Tr.I.		2	51	II. Sh.I.		14	13	I. Tr.E.		21	43	III. Tr.I.
	14	43	I. Sh.I.		3	22	II. Tr.E.		15	18	I. Sh.E.	31	1	18	III. Tr.E.
	15	46	I. Tr.E.		5	44	II. Sh.E.		21	23	II. Oc.D.		1	50	III. Sh.I.
	16	59	I. Sh.E.		12	48	I. Oc.D.						5	27	III. Sh.E.
	21	47	II. Tr.I.		16	17	I. Ec.R.	23	2	30	II. Ec.R.		8	25	I. Tr.I.
7	0	15	II. Sh.I.	15	9	57	I. Tr.I.		9	17	I. Oc.D.		9	25	I. Sh.I.
	0	40	II. Tr.E.		11	07	I. Sh.I.		12	41	I. Ec.R.		10	42	I. Tr.E.
	3	07	II. Sh.E.		12	14	I. Tr.E.		17	26	III. Tr.I.		11	43	I. Sh.E.
	10	50	I. Oc.D.		13	23	I. Sh.E.		21	00	III. Tr.E.		19	20	II. Tr.I.
	14	22	I. Ec.R.		18	40	II. Oc.D.		21	51	III. Sh.I.		21	22	II. Sh.I.
					23	54	II. Ec.R.	24	1	27	III. Sh.E.		22	13	II. Tr.E.
8	8	00	I. Tr.I.	16	7	18	I. Oc.D.		6	26	I. Tr.I.				
	9	12	I. Sh.I.		10	46	I. Ec.R.		7	30	I. Sh.I.				
	10	16	I. Tr.E.		13	10	III. Tr.I.		8	42	I. Tr.E.				
	11	28	I. Sh.E.		16	44	III. Tr.E.		9	47	I. Sh.E.				
	15	58	II. Oc.D.		17	51	III. Sh.I.		16	35	II. Tr.I.				
	21	18	II. Ec.R.		21	27	III. Sh.E.		18	46	II. Sh.I.				
I. May 16				II. May 15				III. May 13				IV. May 20-21			
$x_2=+2.0, y_2=0.0$				$x_2=+2.6, y_2=0.0$				$x_1=+1.6, y_1=+0.1$ $x_2=+3.6, y_2=+0.1$				$x_1=+3.4, y_1=+0.2$ $x_2=+5.3, y_2=+0.2$			

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR MAY
UNIVERSAL TIME



PHASES OF THE ECLIPSES

I				III			
W		r	*	E		d	r
						*	*
II				IV			
W		r	*	E		d	r
						*	*

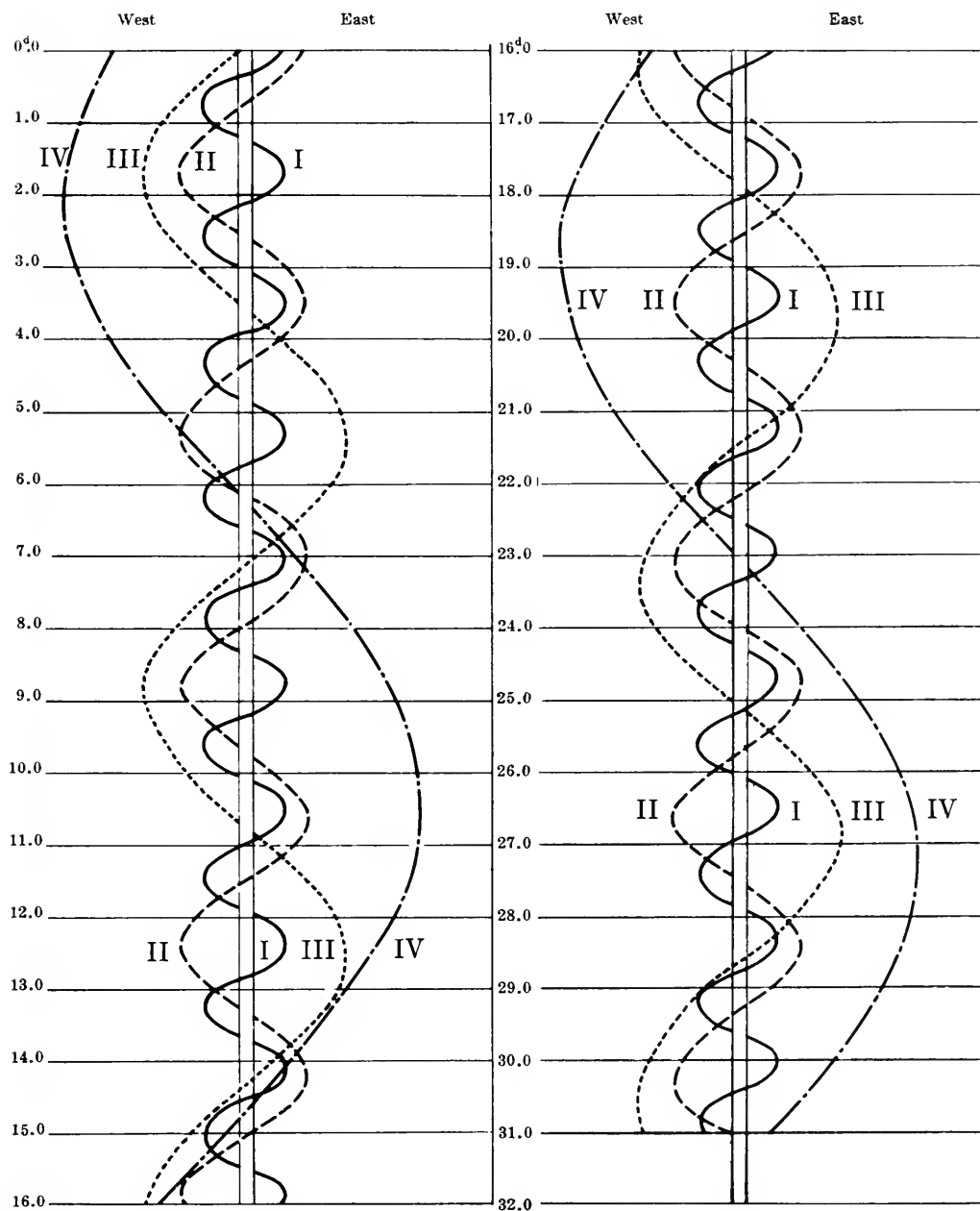
UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

JUNE

d	h	m		d	h	m		d	h	m		d	h	m	
1	0	14	II. Sh.E.	8	2	50	II. Sh.E.	15	5	26	II. Sh.E.	23	7	20	IV. Ec.D.
	5	46	I. Oc.D.		7	46	I. Oc.D.		9	46	I. Oc.D.		8	55	I. Tr.I.
	9	04	I. Ec.R.		10	59	I. Ec.R.		12	54	I. Ec.R.		9	39	I. Sh.I.
													11	12	I. Tr.E.
2	2	55	I. Tr.I.	9	4	55	I. Tr.I.	16	6	55	I. Tr.I.		11	56	I. Sh.E.
	3	54	I. Sh.I.		5	49	I. Sh.I.		7	44	I. Sh.I.		12	11	IV. Ec.R.
	5	12	I. Tr.E.		7	11	I. Tr.E.		9	12	I. Tr.E.		21	53	II. Oc.D.
	6	11	I. Sh.E.		8	06	I. Sh.E.		10	01	I. Sh.E.				
	13	31	II. Oc.D.		16	17	II. Oc.D.		19	05	II. Oc.D.	24	2	15	II. Ec.R.
	18	25	II. Ec.R.		21	02	II. Ec.R.		23	39	II. Ec.R.		6	16	I. Oc.D.
													9	17	I. Ec.R.
3	0	16	I. Oc.D.	10	2	16	I. Oc.D.	17	4	16	I. Oc.D.	25	1	04	III. Oc.D.
	3	33	I. Ec.R.		5	28	I. Ec.R.		7	22	I. Ec.R.		3	26	I. Tr.I.
	11	57	III. Oc.D.		16	18	III. Oc.D.		20	40	III. Oc.D.		4	08	I. Sh.I.
	15	34	III. Oc.R.		19	55	III. Oc.R.						5	43	I. Tr.E.
	15	56	III. Ec.D.		19	55	III. Ec.D.	18	1	25	I. Tr.I.		6	25	I. Sh.E.
	19	34	III. Ec.R.		23	25	I. Tr.I.		2	12	I. Sh.I.		7	33	III. Ec.R.
	21	25	I. Tr.I.		23	34	III. Ec.R.		3	34	III. Ec.R.		17	03	II. Tr.I.
	22	23	I. Sh.I.						3	42	I. Tr.E.		18	26	II. Sh.I.
	23	42	I. Tr.E.	11	0	18	I. Sh.I.		4	30	I. Sh.E.		19	56	II. Tr.E.
					1	42	I. Tr.E.		14	16	II. Tr.I.		21	19	II. Sh.E.
4	0	40	I. Sh.E.		2	35	I. Sh.E.		15	51	II. Sh.I.				
	8	43	II. Tr.I.		11	29	II. Tr.I.		17	09	II. Tr.E.				
	10	40	II. Sh.I.		13	16	II. Sh.I.		18	43	II. Sh.E.	26	0	47	I. Oc.D.
	11	36	II. Tr.E.		14	22	II. Tr.E.		22	46	I. Oc.D.		3	46	I. Ec.R.
	13	32	II. Sh.E.		16	08	II. Sh.E.						21	56	I. Tr.I.
	18	46	I. Oc.D.		20	46	I. Oc.D.	19	1	52	I. Ec.R.		22	36	I. Sh.I.
	22	02	I. Ec.R.		23	56	I. Ec.R.		19	55	I. Tr.I.				
									20	41	I. Sh.I.	27	0	14	I. Tr.E.
5	15	55	I. Tr.I.	12	17	55	I. Tr.I.		22	13	I. Tr.E.		0	55	I. Sh.E.
	16	52	I. Sh.I.		18	47	I. Sh.I.		23	00	I. Sh.E.		11	17	II. Oc.D.
	18	12	I. Tr.E.		20	12	I. Tr.E.						15	34	II. Ec.R.
	19	09	I. Sh.E.		21	04	I. Sh.E.	20	8	29	II. Oc.D.		19	17	I. Oc.D.
									12	57	II. Ec.R.		22	14	I. Ec.R.
6	2	54	II. Oc.D.	13	5	41	II. Oc.D.		17	16	I. Oc.D.	28	15	10	III. Tr.I.
	4	13	IV. Oc.D.		10	20	II. Ec.R.		20	20	I. Ec.R.		16	26	I. Tr.I.
	7	43	II. Ec.R.		15	16	I. Oc.D.						17	05	I. Sh.I.
	8	50	IV. Oc.R.		18	25	I. Ec.R.	21	10	45	III. Tr.I.		17	48	III. Sh.I.
	13	16	I. Oc.D.						13	49	III. Sh.I.		18	44	I. Tr.E.
	13	17	IV. Ec.D.	14	6	23	III. Tr.I.		14	22	III. Tr.E.		18	47	III. Tr.E.
	16	30	I. Ec.R.		9	49	III. Sh.I.		14	25	I. Tr.I.		19	23	I. Sh.E.
	18	06	IV. Ec.R.		9	59	III. Tr.E.		15	10	I. Sh.I.		21	27	III. Sh.E.
					12	25	I. Tr.I.		16	43	I. Tr.E.				
7	2	02	III. Tr.I.		13	15	I. Sh.I.		17	27	III. Sh.E.	29	6	27	II. Tr.I.
	5	37	III. Tr.E.		13	27	III. Sh.E.		17	28	I. Sh.E.		7	44	II. Sh.I.
	5	50	III. Sh.I.		14	42	I. Tr.E.						9	20	II. Tr.E.
	9	27	III. Sh.E.		15	08	IV. Tr.I.	22	3	40	II. Tr.I.		10	36	II. Sh.E.
	10	25	I. Tr.I.		15	33	I. Sh.E.		5	09	II. Sh.I.		13	47	I. Oc.D.
	11	20	I. Sh.I.		19	43	IV. Tr.E.		6	32	II. Tr.E.		16	43	I. Ec.R.
	12	42	I. Tr.E.		22	59	IV. Sh.I.		8	01	II. Sh.E.	30	10	56	I. Tr.I.
	13	38	I. Sh.E.						11	46	I. Oc.D.		11	33	I. Sh.I.
	22	06	II. Tr.I.	15	0	53	II. Tr.I.		14	48	I. Ec.R.		13	14	I. Tr.E.
	23	58	II. Sh.I.		2	33	II. Sh.I.	23	0	21	IV. Oc.D.		13	52	I. Sh.E.
					3	42	IV. Sh.E.		5	03	IV. Oc.R.				
8	0	59	II. Tr.E.		3	45	II. Tr.E.								
I. June 15				II. June 16				III. June 10				IV. June 23			
$x_2=+1.7, \quad y_2=0.0$				$x_2=+2.1, \quad y_2=0.0$				$x_1=+1.0, \quad y_1=+0.1$ $x_2=+3.0, \quad y_2=+0.1$				$x_1=+1.9, \quad y_1=+0.1$ $x_2=+3.8, \quad y_2=+0.1$			

NOTE.—I, denotes ingress; E, egress; D, disappearance; R, reappearance; Ec, eclipse; Oc, occultation; Tr, transit of the satellite; Sh, transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR JUNE
UNIVERSAL TIME



PHASES OF THE ECLIPSES

I		r	*	E	III		d	r	*	E
W					W					
II		r	*	E	IV		d	r	*	E
W					W					

UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

JULY

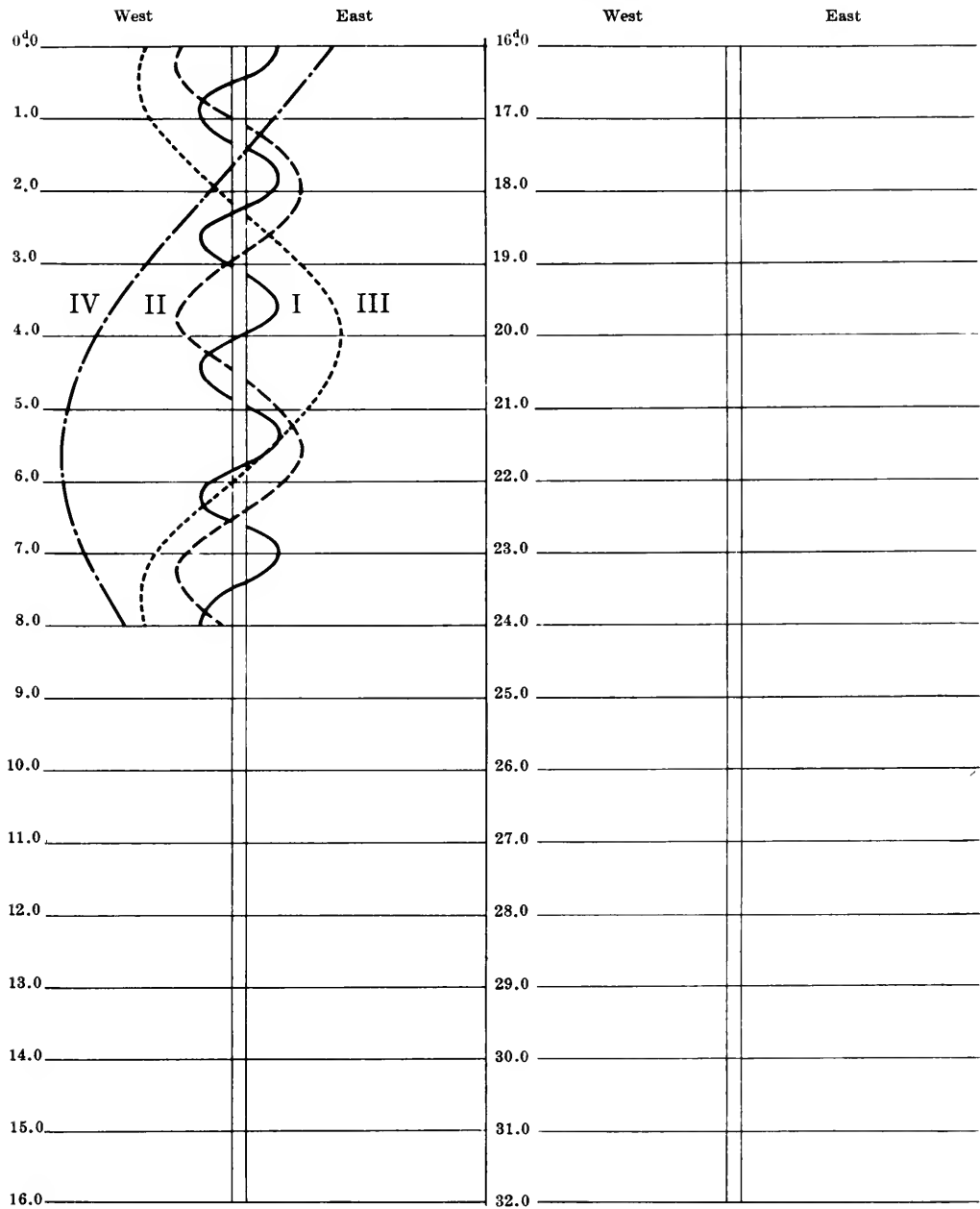
d	h	m		d	h	m		d	h	m		d	h	m	
1	0	42	II. Oc.D.	2	19	51	II. Tr.I.	5	0	09	I. Ec.R.	6	18	37	I. Ec.R.
	4	52	II. Ec.R.		21	02	II. Sh.I.		18	27	I. Tr.I.				
	8	17	I. Oc.D.		22	43	II. Tr.E.		19	00	I. Sh.I.	7	12	57	I. Tr.I.
	11	12	I. Ec.R.		23	54	II. Sh.E.		19	35	III. Tr.I.		13	28	I. Sh.I.
	11	19	IV. Tr.I.						20	45	I. Tr.E.		15	15	I. Tr.E.
	15	59	IV. Tr.E.	3	2	47	I. Oc.D.		21	18	I. Sh.E.		15	47	I. Sh.E.
	16	59	IV. Sh.I.		5	40	I. Ec.R.		21	47	III. Sh.I.				
	21	44	IV. Sh.E.		23	57	I. Tr.I.		23	13	III. Tr.E.	8	3	32	II. Oc.D.
2	5	27	I. Tr.I.	4	0	31	I. Sh.I.	6	1	26	III. Sh.E.		7	29	II. Ec.R.
	5	28	III. Oc.D.		2	15	I. Tr.E.		9	15	II. Tr.I.		10	18	I. Oc.D.
	6	03	I. Sh.I.		2	50	I. Sh.E.		10	19	II. Sh.I.		13	06	I. Ec.R.
	7	44	I. Tr.E.		14	07	II. Oc.D.		12	07	II. Tr.E.				
	8	20	I. Sh.E.		18	10	II. Ec.R.		13	11	II. Sh.E.				
	11	32	III. Ec.R.		21	18	I. Oc.D.		15	48	I. Oc.D.				

By reason of the proximity of JUPITER to the SUN the phenomena of the satellites are not given from July 9 to August 26.



I. July 8	II. July 8	III. July 2	IV.
$x_2=+1.4, y_2=0.0$	$x_2=+1.7, y_2=0.0$	$x_2=+2.3, y_2=+0.1$	No eclipse

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec. eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR JULY
UNIVERSAL TIME



PHASES OF THE ECLIPSES

I		III	
W		E	W
II		IV	
W		E	W
			No eclipse
			E

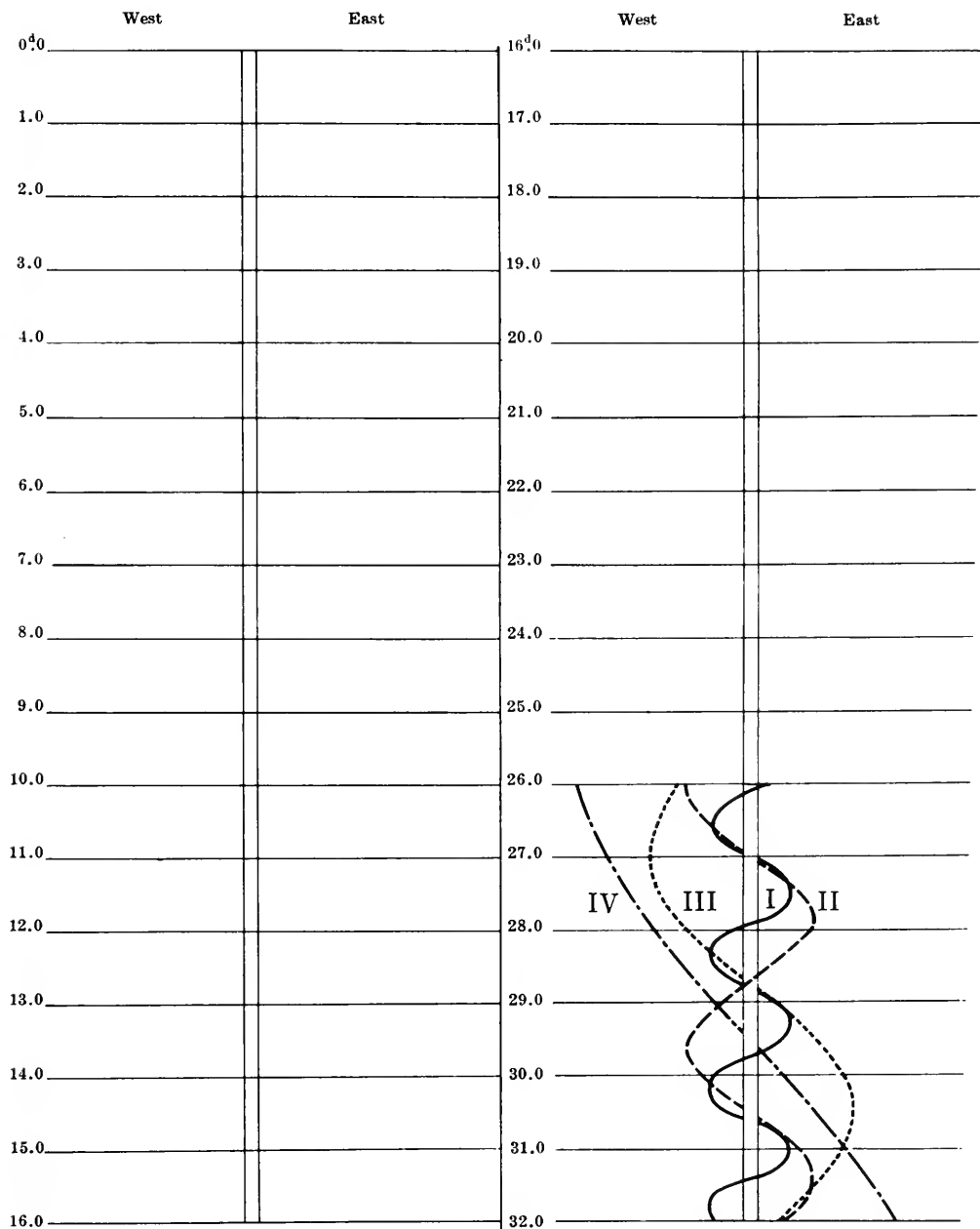
UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

AUGUST

<div>d h m</div> <div>26 2 51</div> <div>3 08</div> <div>5 09</div> <div>5 26</div> <div>22 52</div> <div>I. Sh.I.</div> <div>I. Tr.I.</div> <div>I. Sh.E.</div> <div>I. Tr.E.</div> <div>II. Ec.D.</div>	<div>d h m</div> <div>27 21 38</div> <div>23 38</div> <div>23 57</div> <div>28 15 43</div> <div>17 36</div> <div>18 14</div> <div>18 35</div> <div>20 27</div> <div>20 42</div> <div>I. Tr.I.</div> <div>I. Sh.E.</div> <div>I. Tr.E.</div> <div>III. Ec.D.</div> <div>II. Sh.I.</div> <div>II. Tr.I.</div> <div>I. Ec.D.</div> <div>II. Sh.E.</div> <div>III. Oc.R.</div>	<div>d h m</div> <div>28 21 06</div> <div>21 12</div> <div>29 7 28</div> <div>15 40</div> <div>15 48</div> <div>16 08</div> <div>18 06</div> <div>18 27</div> <div>II. Tr.E.</div> <div>I. Oc.R.</div> <div>IV. Ec.D.</div> <div>IV. Oc.R.</div> <div>I. Sh.I.</div> <div>I. Tr.I.</div> <div>I. Sh.E.</div> <div>I. Tr.E.</div>	<div>d h m</div> <div>30 12 10</div> <div>13 03</div> <div>15 42</div> <div>15 49</div> <div>31 10 17</div> <div>10 39</div> <div>12 35</div> <div>12 57</div> <div>II. Ec.D.</div> <div>I. Ec.D.</div> <div>I. Oc.R.</div> <div>II. Oc.R.</div> <div>I. Sh.I.</div> <div>I. Tr.I.</div> <div>I. Sh.E.</div> <div>I. Tr.E.</div>
I. Aug. 27	II. Aug. 26	III. Aug. 28	IV. Aug. 29
$x_1=-1.3, y_1=0.0$	$x_1=-1.4, y_1=-0.1$	$x_1=-1.7, y_1=0.0$	$x_1=-2.3, y_1=0.0$

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance ;Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR AUGUST
UNIVERSAL TIME



PHASES OF THE ECLIPSES

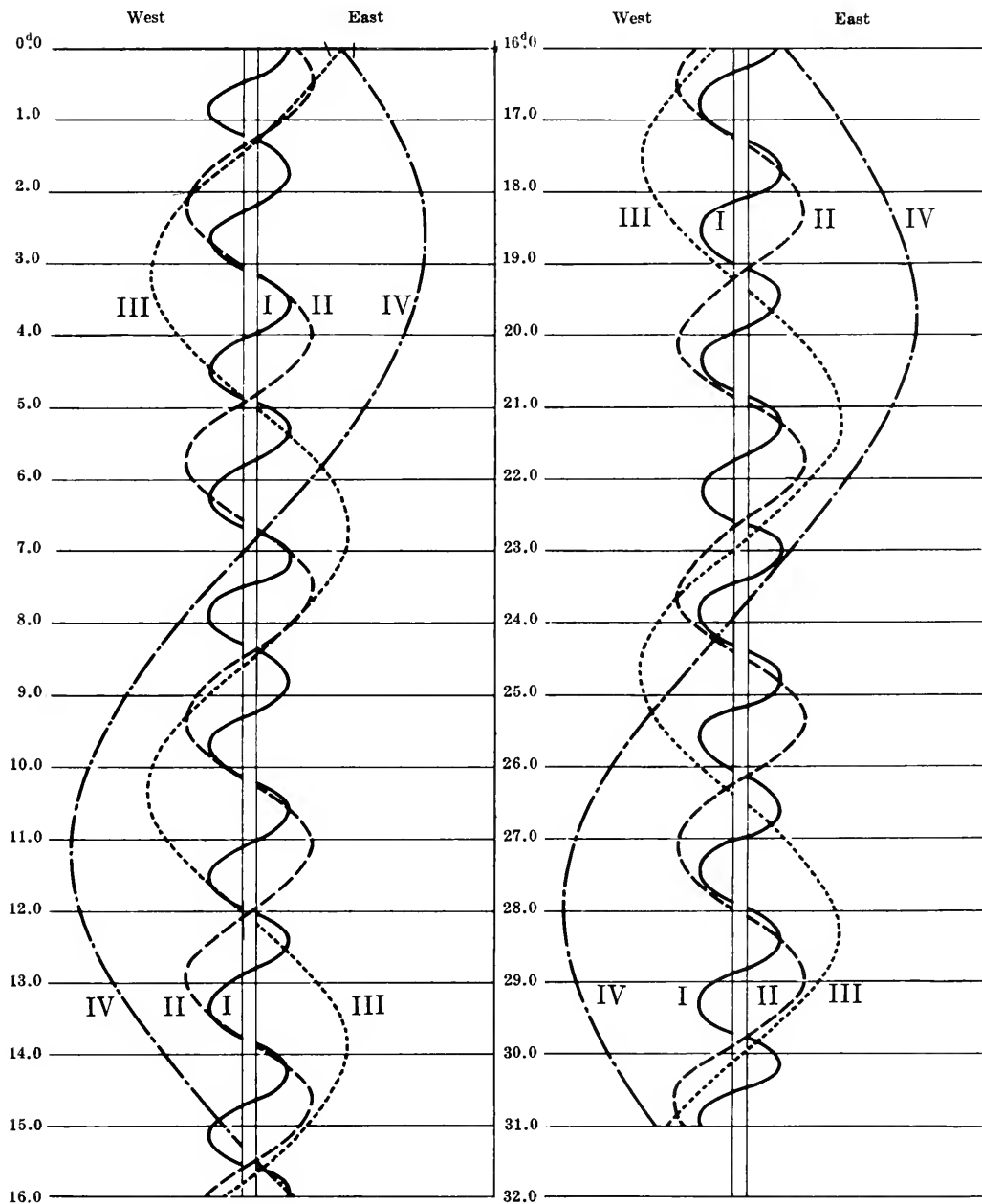
I	d		E	III	d		E
W	*			W	*		
II	d		E	IV	d		E
W	*			W	*		

UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

SEPTEMBER											
d	h	m		d	h	m		d	h	m	
1	5	40	III. Sh.I.	8	10	25	II. Tr.I.	15	16	02	II. Tr.E.
	6	52	II. Sh.I.		11	40	III. Tr.I.		16	05	III. Tr.I.
	7	14	III. Tr.I.		12	12	I. Oc.R.		17	17	III. Sh.E.
	7	32	I. Ec.D.		12	17	II. Sh.E.		19	45	III. Tr.E.
	7	38	II. Tr.I.		13	16	II. Tr.E.				
	9	20	III. Sh.E.		13	18	III. Sh.E.	16	8	33	I. Sh.I.
	9	44	II. Sh.E.		15	20	III. Tr.E.		9	10	I. Tr.I.
	10	12	I. Oc.R.						10	52	I. Sh.E.
	10	29	II. Tr.E.	9	6	39	I. Sh.I.		11	29	I. Tr.E.
	10	54	III. Tr.E.		7	10	I. Tr.I.				
					8	57	I. Sh.E.	17	5	47	I. Ec.D.
2	4	45	I. Sh.I.		9	28	I. Tr.E.		6	42	II. Ec.D.
	5	09	I. Tr.I.						8	42	I. Oc.R.
	7	03	I. Sh.E.	10	3	53	I. Ec.D.		10	54	II. Oc.R.
	7	27	I. Tr.E.		4	05	II. Ec.D.				
					6	42	I. Oc.R.	18	3	02	I. Sh.I.
3	1	29	II. Ec.D.		8	05	II. Oc.R.		3	41	I. Tr.I.
	2	00	I. Ec.D.						5	20	I. Sh.E.
	4	42	I. Oc.R.	11	1	08	I. Sh.I.		5	59	I. Tr.E.
	5	14	II. Oc.R.		1	40	I. Tr.I.				
	23	14	I. Sh.I.		3	26	I. Sh.E.	19	0	15	I. Ec.D.
	23	39	I. Tr.I.		3	59	I. Tr.E.		1	16	II. Sh.I.
					22	22	I. Ec.D.		2	34	II. Tr.I.
4	1	32	I. Sh.E.		22	43	II. Sh.I.		3	12	I. Oc.R.
	1	58	I. Tr.E.		23	39	III. Ec.D.		3	37	III. Ec.D.
	19	40	III. Ec.D.		23	48	II. Tr.I.		4	07	II. Sh.E.
	20	09	II. Sh.I.						5	25	II. Tr.E.
	20	28	I. Ec.D.	12	1	12	I. Oc.R.		9	57	III. Oc.R.
	21	01	II. Tr.I.		1	34	II. Sh.E.		21	30	I. Sh.I.
	23	00	II. Sh.E.		2	39	II. Tr.E.		22	11	I. Tr.I.
	23	12	I. Oc.R.		5	33	III. Oc.R.		23	49	I. Sh.E.
	23	53	II. Tr.E.		19	36	I. Sh.I.				
					20	10	I. Tr.I.	20	0	29	I. Tr.E.
5	1	07	III. Oc.R.		21	55	I. Sh.E.		18	44	I. Ec.D.
	17	42	I. Sh.I.		22	29	I. Tr.E.		19	59	II. Ec.D.
	18	09	I. Tr.I.						21	42	I. Oc.R.
	20	00	I. Sh.E.	13	16	50	I. Ec.D.				
	20	28	I. Tr.E.		17	23	II. Ec.D.	21	0	18	II. Oc.R.
					19	42	I. Oc.R.		15	59	I. Sh.I.
6	14	46	II. Ec.D.		21	29	II. Oc.R.		16	41	I. Tr.I.
	14	57	I. Ec.D.						18	17	I. Sh.E.
	16	56	IV. Sh.I.	14	14	05	I. Sh.I.		18	59	I. Tr.E.
	17	42	I. Oc.R.		14	41	I. Tr.I.				
	18	39	II. Oc.R.		16	23	I. Sh.E.	22	13	12	I. Ec.D.
	21	21	IV. Tr.I.		16	59	I. Tr.E.		14	33	II. Sh.I.
	21	44	IV. Sh.E.						15	57	II. Tr.I.
				15	1	29	IV. Ec.D.		16	12	I. Oc.R.
7	2	10	IV. Tr.E.		6	23	IV. Ec.R.		17	24	II. Sh.E.
	12	11	I. Sh.I.		7	16	IV. Oc.D.		17	36	III. Sh.I.
	12	40	I. Tr.I.		11	19	I. Ec.D.		18	47	II. Tr.E.
	14	29	I. Sh.E.		12	00	II. Sh.I.		20	29	III. Tr.I.
	14	58	I. Tr.E.		12	12	IV. Oc.R.		21	15	III. Sh.E.
					13	11	II. Tr.I.				
8	9	25	I. Ec.D.		13	38	III. Sh.I.	23	0	08	III. Tr.E.
	9	26	II. Sh.I.		14	12	I. Oc.R.		10	27	I. Sh.I.
	9	39	III. Sh.I.		14	50	II. Sh.E.		10	55	IV. Sh.I.
I. Sept. 15			II. Sept. 17			III. Sept. 19			IV. Sept. 15		
$x_1 = -1.5, \quad y_1 = 0.0$			$x_1 = -1.9, \quad y_1 = -0.1$			$x_1 = -2.5, \quad y_1 = 0.0$			$x_1 = -3.3, \quad y_1 = -0.1$ $x_2 = -1.3, \quad y_2 = 0.0$		

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR SEPTEMBER
UNIVERSAL TIME



PHASES OF THE ECLIPSES

I W	d •		E	III W	d •		E
II W	d •		E	IV W	d •	r • 	E

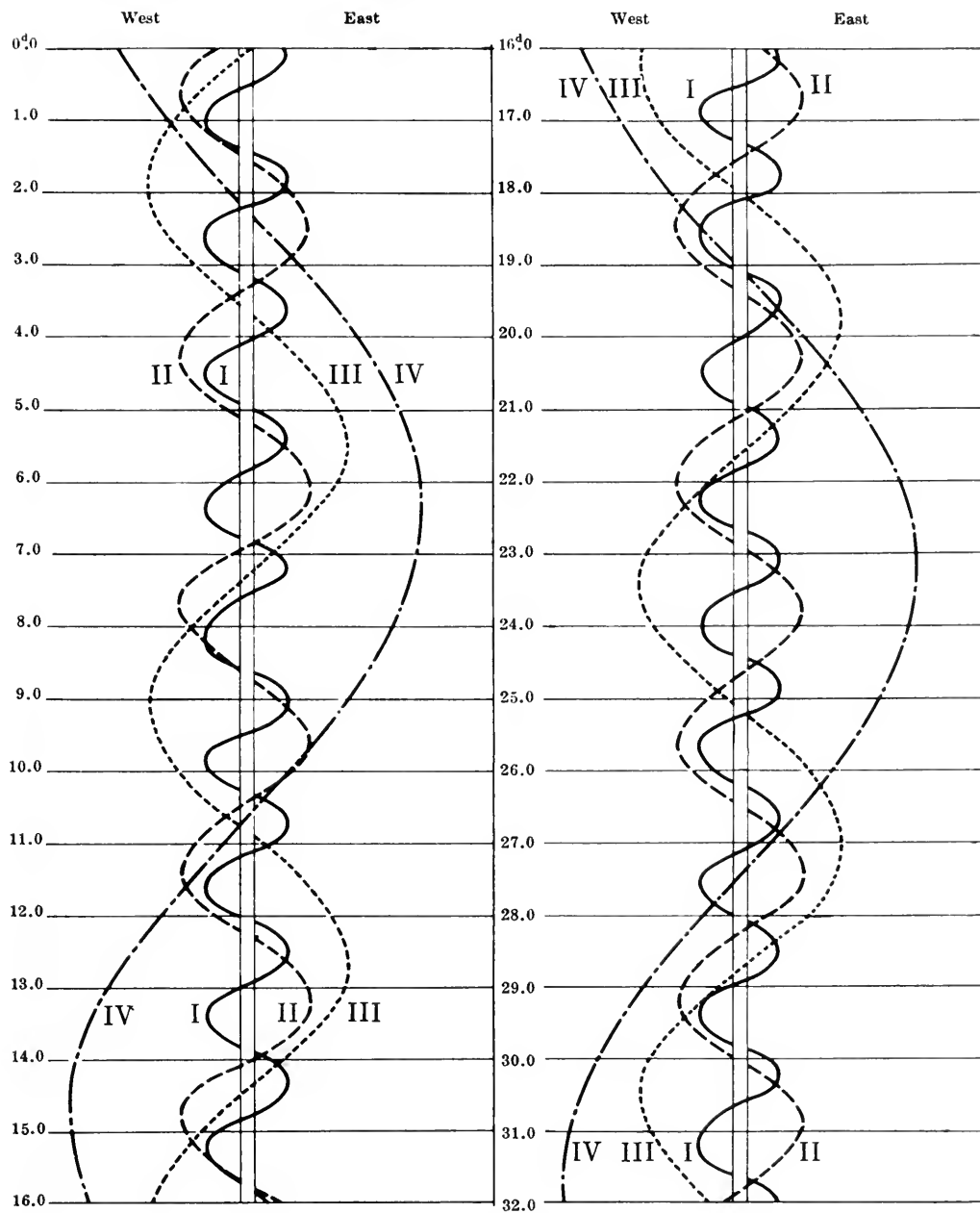
UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

OCTOBER





d	h	m		d	h	m		d	h	m		d	h	m		
1	9	34	I. Ec.D.	9	9	40	I. Tr.I.	17	7	48	I. Ec.D.	24	16	54	II. Sh.E.	
	11	54	II. Ec.D.		11	02	I. Sh.E.		11	06	I. Oc.R.		19	02	II. Tr.E.	
	12	40	I. Oc.R.		11	57	I. Tr.E.		11	30	II. Sh.I.		23	26	III. Ec.D.	
	16	30	II. Oc.R.						13	30	II. Tr.I.					
	19	29	IV. Ec.D.	10	4	53	IV. Sh.I.		14	20	II. Sh.E.	25	3	05	III. Ec.R.	
					5	55	I. Ec.D.		16	20	II. Tr.E.		3	52	III. Oc.D.	
2	0	22	IV. Ec.R.		8	57	II. Sh.I.		19	29	III. Ec.D.		7	00	I. Sh.I.	
	3	33	IV. Oc.D.		9	09	I. Oc.R.		23	07	III. Ec.R.		7	29	III. Oc.R.	
	6	50	I. Sh.I.		9	39	IV. Sh.E.		23	37	III. Oc.D.		8	06	I. Tr.I.	
	7	41	I. Tr.I.		10	48	II. Tr.I.						9	18	I. Sh.E.	
	8	27	IV. Oc.R.		11	47	II. Sh.E.	18	3	15	III. Oc.R.		10	23	I. Tr.E.	
	9	08	I. Sh.E.		13	38	II. Tr.E.		5	06	I. Sh.I.					
	9	58	I. Tr.E.		13	40	IV. Tr.I.		6	08	I. Tr.I.	26	4	10	I. Ec.D.	
					15	31	III. Ec.D.		7	24	I. Sh.E.		7	33	I. Oc.R.	
3	4	02	I. Ec.D.		18	25	IV. Tr.E.		8	25	I. Tr.E.		9	00	II. Ec.D.	
	6	23	II. Sh.I.		19	10	III. Ec.R.		13	29	IV. Ec.D.		14	08	II. Oc.R.	
	7	10	I. Oc.R.		19	21	III. Oc.D.		18	22	IV. Ec.R.		22	50	IV. Sh.I.	
	8	04	II. Tr.I.		22	59	III. Oc.R.		23	29	IV. Oc.D.					
	9	14	II. Sh.E.									27	1	29	I. Sh.I.	
	10	54	II. Tr.E.	11	3	13	I. Sh.I.		19	2	16		2	35	I. Tr.I.	
	11	34	III. Ec.D.		4	09	I. Tr.I.			4	18	IV. Oc.R.		3	35	IV. Sh.E.
	18	41	III. Oc.R.		5	30	I. Sh.E.			5	36	I. Oc.R.		3	46	I. Sh.E.
					6	27	I. Tr.E.			6	24	II. Ec.D.		4	52	I. Tr.E.
4	1	19	I. Sh.I.							11	25	II. Oc.R.		9	15	IV. Tr.I.
	2	10	I. Tr.I.							23	35	I. Sh.I.		13	53	IV. Tr.E.
	3	36	I. Sh.E.	12	0	23	I. Ec.D.						22	38	I. Ec.D.	
	4	28	I. Tr.E.		3	38	I. Oc.R.									
	22	30	I. Ec.D.		3	48	II. Ec.D.		20	0	37	I. Tr.I.				
					8	40	II. Oc.R.			1	53	I. Sh.E.	28	2	02	I. Oc.R.
5	1	12	II. Ec.D.		21	41	I. Sh.I.			2	55	I. Tr.E.		3	20	II. Sh.I.
	1	40	I. Oc.R.		22	39	I. Tr.I.			20	45	I. Ec.D.		5	33	II. Tr.I.
	5	53	II. Oc.R.		23	59	I. Sh.E.							6	10	II. Sh.E.
	19	47	I. Sh.I.						21	0	05	I. Oc.R.		8	22	II. Tr.E.
	20	40	I. Tr.I.	13	0	57	I. Tr.E.			0	47	II. Sh.I.		13	29	III. Sh.I.
	22	05	I. Sh.E.		18	52	I. Ec.D.			2	52	II. Tr.I.		17	06	III. Sh.E.
	22	58	I. Tr.E.		22	08	I. Oc.R.			3	37	II. Sh.E.		18	02	III. Tr.I.
					22	13	II. Sh.I.			5	41	II. Tr.E.		19	57	I. Sh.I.
6	16	58	I. Ec.D.							9	31	III. Sh.I.		21	04	I. Tr.I.
	19	40	II. Sh.I.	14	0	09	II. Tr.I.			13	08	III. Sh.E.		21	38	III. Tr.E.
	20	09	I. Oc.R.		1	04	II. Sh.E.			13	48	III. Tr.I.		22	14	I. Sh.E.
	21	26	II. Tr.I.		2	59	II. Tr.E.			17	25	III. Tr.E.		23	21	I. Tr.E.
	22	30	II. Sh.E.		5	32	III. Sh.I.			18	03	I. Sh.I.				
					9	09	III. Sh.E.			19	07	I. Tr.I.	29	17	06	I. Ec.D.
7	0	16	II. Tr.E.		9	31	III. Tr.I.			20	21	I. Sh.E.		20	31	I. Oc.R.
	1	33	III. Sh.I.		13	09	III. Tr.E.			21	24	I. Tr.E.		22	18	II. Ec.D.
	5	11	III. Sh.E.		16	09	I. Sh.I.									
	5	13	III. Tr.I.		17	09	I. Tr.I.		22	15	13	I. Ec.D.	30	3	30	II. Oc.R.
	8	50	III. Tr.E.		18	27	I. Sh.E.			18	34	I. Oc.R.		14	25	I. Sh.I.
	14	16	I. Sh.I.		19	26	I. Tr.E.			19	42	II. Ec.D.		15	33	I. Tr.I.
	15	10	I. Tr.I.											16	42	I. Sh.E.
	16	33	I. Sh.E.	15	13	20	I. Ec.D.							17	50	I. Tr.E.
	17	28	I. Tr.E.		16	37	I. Oc.R.		23	0	47	II. Oc.R.				
					17	06	II. Ec.D.			12	32	I. Sh.I.				
8	11	27	I. Ec.D.		22	03	II. Oc.R.			13	36	I. Tr.I.		11	34	I. Ec.D.
	14	30	II. Ec.D.							14	49	I. Sh.E.		15	00	I. Oc.R.
	14	39	I. Oc.R.	16	10	38	I. Sh.I.			15	53	I. Tr.E.		16	37	II. Sh.I.
	19	17	II. Oc.R.		11	38	I. Tr.I.		24	9	41	I. Ec.D.		18	53	II. Tr.I.
					12	55	I. Sh.E.			13	04	I. Oc.R.		19	27	II. Sh.E.
9	8	44	I. Sh.I.		13	55	I. Tr.E.			14	03	II. Sh.I.		21	42	II. Tr.E.
										16	12	II. Tr.I.				
I. Oct. 17				II. Oct. 15				III. Oct. 17				IV. Oct. 18				
$x_1 = -1.9, y_1 = 0.0$				$x_1 = -2.4, y_1 = -0.1$				$x_1 = -3.2, y_1 = -0.1$ $x_2 = -1.3, y_2 = -0.1$				$x_1 = -5.0, y_1 = -0.1$ $x_2 = -3.0, y_2 = -0.1$				

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR OCTOBER
UNIVERSAL TIME



PHASES OF THE ECLIPSES

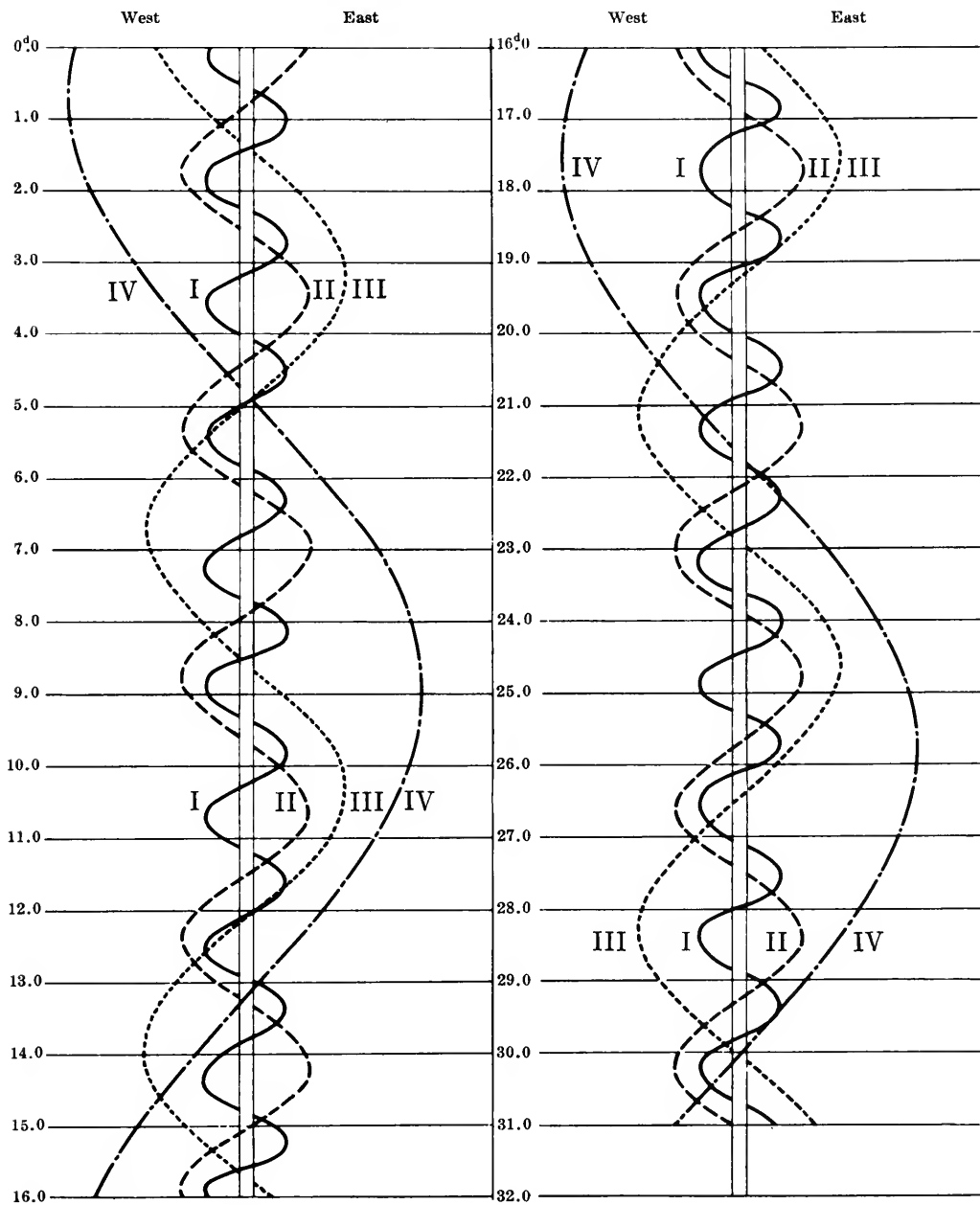
<p>I W d </p>	<p>III E W d r  E</p>
<p>II W d </p>	<p>IV E W d r  E</p>

UNIVERSAL TIME OF GEOCENTRIC PHENOMENA





NOVEMBER											
d	h	m		d	h	m		d	h	m	
1	3	24	III. Ec.D.	8	11	59	I. Tr.I.	15	16	20	III. Oc.D.
	7	03	III. Ec.R.		12	14	III. Oc.D.		15	14	III. Oc.R.
	8	05	III. Oc.D.		13	05	I. Sh.E.		19	21	II. Ec.D.
	8	54	I. Sh.I.		14	16	I. Tr.E.	16	9	49	I. Ec.D.
	10	03	I. Tr.I.		15	50	III. Oc.R.		13	20	I. Oc.R.
	11	11	I. Sh.E.						16	46	II. Ec.D.
	11	41	III. Oc.R.	9	7	56	I. Ec.D.		22	08	II. Oc.R.
	12	20	I. Tr.E.		11	25	I. Oc.R.				
					14	11	II. Ec.D.	17	7	10	I. Sh.I.
2	6	03	I. Ec.D.		19	30	II. Oc.R.		8	23	I. Tr.I.
	9	29	I. Oc.R.						9	27	I. Sh.E.
	11	35	II. Ec.D.	10	5	16	I. Sh.I.		10	39	I. Tr.E.
	16	50	II. Oc.R.		6	28	I. Tr.I.				
					7	33	I. Sh.E.	18	4	17	I. Ec.D.
3	3	22	I. Sh.I.		8	45	I. Tr.E.		7	49	I. Oc.R.
	4	32	I. Tr.I.						11	01	II. Sh.I.
	5	40	I. Sh.E.	11	2	24	I. Ec.D.		13	28	II. Tr.I.
	6	49	I. Tr.E.		5	54	I. Oc.R.		13	51	II. Sh.E.
					8	27	II. Sh.I.		16	17	II. Tr.E.
4	0	31	I. Ec.D.		10	51	II. Tr.I.				
	3	58	I. Oc.R.		11	17	II. Sh.E.	19	1	22	III. Sh.I.
	5	54	II. Sh.I.		13	40	II. Tr.E.		1	38	I. Sh.I.
	7	29	IV. Ec.D.		21	25	III. Sh.I.		2	52	I. Tr.I.
	8	13	II. Tr.I.		23	44	I. Sh.I.		3	55	I. Sh.E.
	8	44	II. Sh.E.						4	59	III. Sh.E.
	11	02	II. Tr.E.	12	0	57	I. Tr.I.		5	08	I. Tr.E.
	12	21	IV. Ec.R.		1	01	III. Sh.E.		6	24	III. Tr.I.
	17	27	III. Sh.I.		2	01	I. Sh.E.		9	58	III. Tr.E.
	18	52	IV. Oc.D.		2	20	III. Tr.I.		22	45	I. Ec.D.
	21	04	III. Sh.E.		3	13	I. Tr.E.	20	2	17	I. Oc.R.
	21	51	I. Sh.I.		5	54	III. Tr.E.		6	04	II. Ec.D.
	22	13	III. Tr.I.		16	48	IV. Sh.I.		11	27	II. Oc.R.
	23	01	I. Tr.I.		20	52	I. Ec.D.		20	06	I. Sh.I.
	23	35	IV. Oc.R.		21	31	IV. Sh.E.		21	20	I. Tr.I.
									22	23	I. Sh.E.
5	0	08	I. Sh.E.	13	0	23	I. Oc.R.		23	37	I. Tr.E.
	1	18	I. Tr.E.		3	29	II. Ec.D.	21	1	28	IV. Ec.D.
	1	48	III. Tr.E.		4	15	IV. Tr.I.		6	18	IV. Ec.R.
	18	59	I. Ec.D.		8	47	IV. Tr.E.		13	34	IV. Oc.D.
	22	27	I. Oc.R.		8	50	II. Oc.R.		17	14	I. Ec.D.
					18	12	I. Sh.I.		18	10	IV. Oc.R.
6	0	53	II. Ec.D.		19	25	I. Tr.I.		20	46	I. Oc.R.
	6	11	II. Oc.R.		20	30	I. Sh.E.	22	0	18	II. Sh.I.
	16	19	I. Sh.I.		21	42	I. Tr.E.		2	46	II. Tr.I.
	17	29	I. Tr.I.						3	07	II. Sh.E.
	18	36	I. Sh.E.	14	15	20	I. Ec.D.		5	34	II. Tr.E.
	19	47	I. Tr.E.		18	51	I. Oc.R.		14	35	I. Sh.I.
					21	44	II. Sh.I.		15	18	III. Ec.D.
7	13	27	I. Ec.D.						15	49	I. Tr.I.
	16	56	I. Oc.R.	15	0	10	II. Tr.I.		16	51	I. Sh.E.
	19	10	II. Sh.I.		0	34	II. Sh.E.		18	05	I. Tr.E.
	21	32	II. Tr.I.		2	58	II. Tr.E.		18	56	III. Ec.R.
	22	00	II. Sh.E.		11	20	III. Ec.D.		20	22	III. Oc.D.
					12	41	I. Sh.I.		23	57	III. Oc.R.
8	0	21	II. Tr.E.		13	54	I. Tr.I.				
	7	22	III. Ec.D.		14	58	I. Sh.E.				
	10	48	I. Sh.I.		14	59	III. Ec.R.				
	11	00	III. Ec.R.		16	11	I. Tr.E.				
I. Nov. 16			II. Nov. 16			III. Nov. 15			IV. Nov. 21		
$x_1 = -2.0, \quad y_1 = 0.0$			$x_1 = -2.7, \quad y_1 = -0.1$			$x_1 = -3.7, \quad y_1 = -0.1$ $x_2 = -1.7, \quad y_2 = -0.1$			$x_1 = -5.8, \quad y_1 = -0.1$ $x_2 = -3.9, \quad y_2 = -0.1$		

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR NOVEMBER
UNIVERSAL TIME



PHASES OF THE ECLIPSES

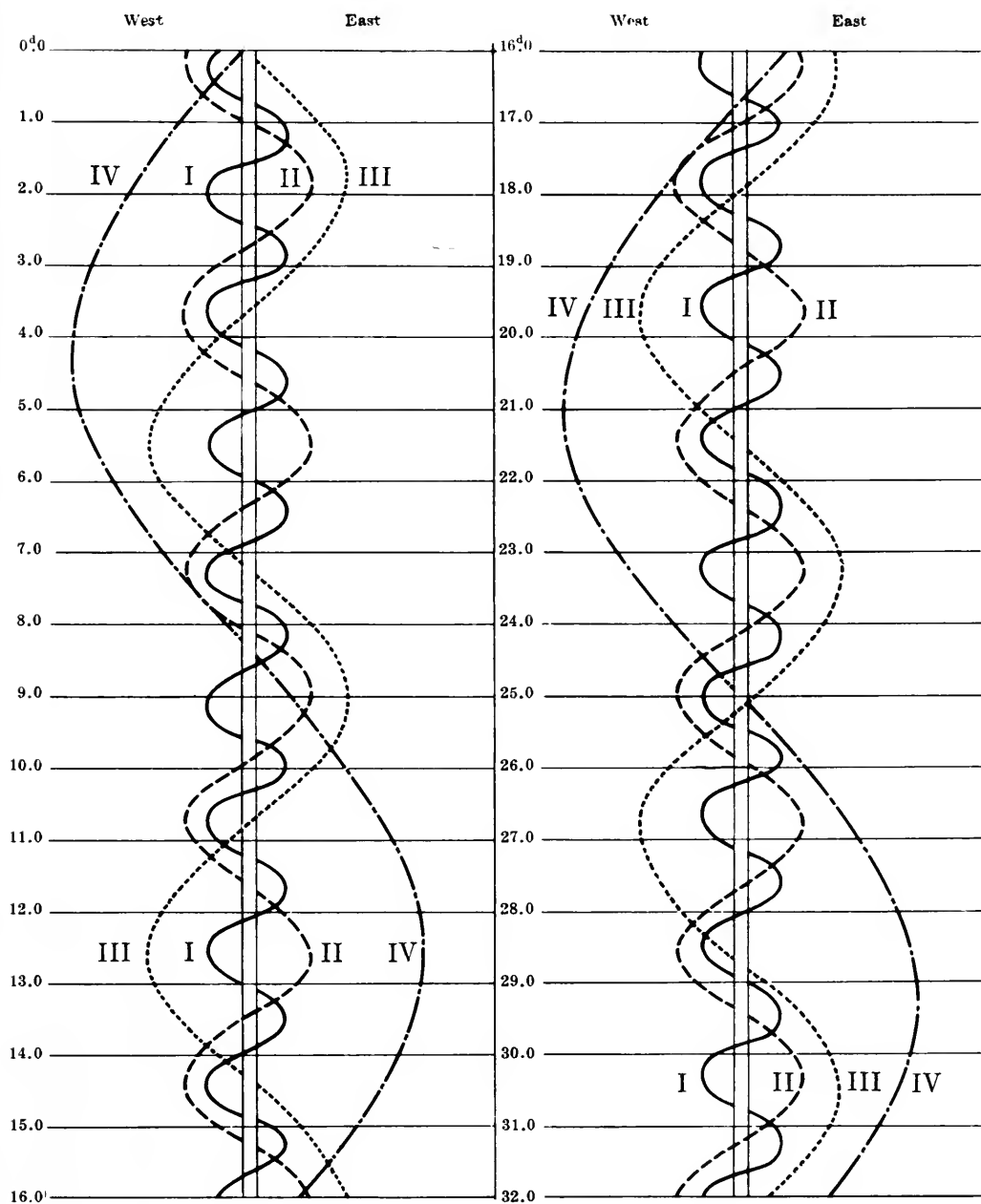
I W	d •		III E	d •	r •		E
II W	d •		IV E	d •	r •		E

UNIVERSAL TIME OF GEOCENTRIC PHENOMENA





DECEMBER															
d	h	m		d	h	m		d	h	m		d	h	m	
1	3	19	II. Oc.R.	9	9	56	I. Ec.D.	17	2	26	II. Tr.E.	25	0	47	III. Sh.E.
	10	57	I. Sh.I.		13	27	I. Oc.R.		9	11	I. Sh.I.		1	43	III. Tr.I.
	12	11	I. Tr.I.		18	42	II. Sh.I.		10	21	I. Tr.I.		4	42	IV. Oc.R.
	13	13	I. Sh.E.		21	08	II. Tr.I.		11	28	I. Sh.E.		5	13	III. Tr.E.
	14	27	I. Tr.E.		21	32	II. Sh.E.		12	37	I. Tr.E.		8	11	I. Ec.D.
					23	57	II. Tr.E.		17	14	III. Sh.I.		11	35	I. Oc.R.
2	8	03	I. Ec.D.						20	50	III. Sh.E.		18	58	II. Ec.D.
	11	35	I. Oc.R.	10	7	18	I. Sh.I.		22	00	III. Tr.I.				
	16	08	II. Sh.I.		8	30	I. Tr.I.					26	0	01	II. Oc.R.
	18	37	II. Tr.I.		9	35	I. Sh.E.	18	1	31	III. Tr.E.		5	33	I. Sh.I.
	18	58	II. Sh.E.		10	46	I. Tr.E.		6	18	I. Ec.D.		6	38	I. Tr.I.
	21	25	II. Tr.E.		13	16	III. Sh.I.		9	46	I. Oc.R.		7	50	I. Sh.E.
					16	52	III. Sh.E.		16	24	II. Ec.D.		8	54	I. Tr.E.
3	5	25	I. Sh.I.		18	13	III. Tr.I.		21	35	II. Oc.R.				
	6	38	I. Tr.I.		21	44	III. Tr.E.					27	2	39	I. Ec.D.
	7	41	I. Sh.E.					19	3	40	I. Sh.I.		6	02	I. Oc.R.
	8	55	I. Tr.E.	11	4	25	I. Ec.D.		4	49	I. Tr.I.		13	07	II. Sh.I.
	9	18	III. Sh.I.		7	55	I. Oc.R.		5	56	I. Sh.E.		15	18	II. Tr.I.
	12	54	III. Sh.E.		13	49	II. Ec.D.		7	05	I. Tr.E.		15	58	II. Sh.E.
	14	21	III. Tr.I.		19	06	II. Oc.R.						18	06	II. Tr.E.
	17	53	III. Tr.E.					20	0	46	I. Ec.D.				
4	2	31	I. Ec.D.	12	1	46	I. Sh.I.		4	13	I. Oc.R.	28	0	01	I. Sh.I.
	6	03	I. Oc.R.		2	58	I. Tr.I.		10	33	II. Sh.I.		1	05	I. Tr.I.
	11	14	II. Ec.D.		4	03	I. Sh.E.		12	52	II. Tr.I.		2	18	I. Sh.E.
	16	35	II. Oc.R.		5	14	I. Tr.E.		13	23	II. Sh.E.		3	21	I. Tr.E.
	23	53	I. Sh.I.		22	53	I. Ec.D.		15	40	II. Tr.E.		11	06	III. Ec.D.
				13	2	23	I. Oc.R.		22	08	I. Sh.I.		14	43	III. Ec.R.
5	1	07	I. Tr.I.		7	59	II. Sh.I.		23	16	I. Tr.I.		15	28	III. Oc.D.
	2	10	I. Sh.E.		10	23	II. Tr.I.	21	0	25	I. Sh.E.		19	00	III. Oc.R.
	3	23	I. Tr.E.		10	49	II. Sh.E.		1	32	I. Tr.E.		21	08	I. Ec.D.
	21	00	I. Ec.D.		13	11	II. Tr.E.		7	08	III. Ec.D.	29	0	29	I. Oc.R.
					20	15	I. Sh.I.		10	45	III. Ec.R.		8	15	II. Ec.D.
6	0	31	I. Oc.R.		21	26	I. Tr.I.		11	48	III. Oc.D.		13	13	II. Oc.R.
	5	25	II. Sh.I.		22	31	I. Sh.E.		15	20	III. Oc.R.		18	29	I. Sh.I.
	7	53	II. Tr.I.		23	42	I. Tr.E.		19	14	I. Ec.D.		19	32	I. Tr.I.
	8	15	II. Sh.E.						22	40	I. Oc.R.		20	46	I. Sh.E.
	10	41	II. Tr.E.	14	3	10	III. Ec.D.						21	48	I. Tr.E.
	18	21	I. Sh.I.		6	47	III. Ec.R.	22	5	41	II. Ec.D.				
	19	35	I. Tr.I.		8	03	III. Oc.D.		10	48	II. Oc.R.	30	15	36	I. Ec.D.
	20	38	I. Sh.E.		11	35	III. Oc.R.		16	36	I. Sh.I.		18	56	I. Oc.R.
	21	51	I. Tr.E.		17	21	I. Ec.D.		17	43	I. Tr.I.				
	23	12	III. Ec.D.		20	50	I. Oc.R.		18	53	I. Sh.E.	31	2	24	II. Sh.I.
									19	59	I. Tr.E.		4	30	II. Tr.I.
7	2	50	III. Ec.R.	15	3	06	II. Ec.D.						5	15	II. Sh.E.
	4	13	III. Oc.D.		8	21	II. Oc.R.	23	13	43	I. Ec.D.		7	18	II. Tr.E.
	7	47	III. Oc.R.		14	43	I. Sh.I.		17	08	I. Oc.R.		12	58	I. Sh.I.
	15	28	I. Ec.D.		15	54	I. Tr.I.		23	50	II. Sh.I.		13	59	I. Tr.I.
	18	59	I. Oc.R.		17	00	I. Sh.E.						15	14	I. Sh.E.
	19	28	IV. Ec.D.		18	10	I. Tr.E.	24	2	05	II. Tr.I.		16	15	I. Tr.E.
									2	40	II. Sh.E.				
8	0	17	IV. Ec.R.	16	4	41	IV. Sh.I.		4	53	II. Tr.E.	32	1	09	III. Sh.I.
	0	31	II. Ec.D.		9	21	IV. Sh.E.		11	04	I. Sh.I.		4	45	III. Sh.E.
	5	51	II. Oc.R.		11	49	I. Ec.D.		12	11	I. Tr.I.		5	20	III. Tr.I.
	7	26	IV. Oc.D.		15	18	I. Oc.R.		13	21	I. Sh.E.		8	50	III. Tr.E.
	11	55	IV. Oc.R.		15	51	IV. Tr.I.		13	27	IV. Ec.D.		10	04	I. Ec.D.
	12	50	I. Sh.I.		20	10	IV. Tr.E.		14	27	I. Tr.E.		13	23	I. Oc.R.
	14	03	I. Tr.I.		21	16	II. Sh.I.		18	14	IV. Ec.R.		21	33	II. Ec.D.
	15	06	I. Sh.E.		23	38	II. Tr.I.		21	11	III. Sh.I.		22	38	IV. Sh.I.
	16	19	I. Tr.E.					25	0	19	IV. Oc.D.				
				17	0	06	II. Sh.E.								
I. Dec. 16				II. Dec. 15				III. Dec. 14				IV. Dec. 24			
$x_1 = -2.0, \quad y_1 = 0.0$				$x_1 = -2.6, \quad y_1 = -0.1$				$x_1 = -3.6, \quad y_1 = -0.1$ $x_2 = -1.7, \quad y_2 = -0.1$				$x_1 = -5.3, \quad y_1 = -0.2$ $x_2 = -3.4, \quad y_2 = -0.2$			

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR DECEMBER
UNIVERSAL TIME



PHASES OF THE ECLIPSES

<p>I W d *</p> 	<p>III E W d r *</p>  <p>E</p>
<p>II W d *</p> 	<p>IV E W d r *</p>  <p>E</p>

364

RINGS OF SATURN, 1967
FOR 0^h UNIVERSAL TIME

Date	Axes of outer edge of outer ring		U	B	P	U'	B'	P'
	Major	Minor						
	"	"	°	°	°	°	°	°
Jan. - 2	38.68	0.19	226.260	-0.275	+4.583	190.401	-2.930	+27.588
2	38.43	0.27	226.462	0.397	4.565	190.521	2.989	27.577
6	38.18	0.35	226.685	0.529	4.546	190.641	3.049	27.565
10	37.94	0.44	226.929	0.672	4.524	190.761	3.109	27.554
14	37.72	0.54	227.193	0.825	4.501	190.881	3.169	27.542
			284					
18	37.50	0.65	227.477	-0.987	+4.476	191.001	-3.229	+27.530
22	37.30	0.75	227.778	1.158	4.450	191.121	3.289	27.517
26	37.10	0.87	228.096	1.337	4.422	191.241	3.349	27.505
30	36.92	0.98	228.430	1.523	4.392	191.361	3.409	27.493
Feb. 3	36.75	1.10	228.778	1.716	4.361	191.482	3.469	27.480
			363					
7	36.59	1.22	229.141	-1.916	+4.329	191.602	-3.529	+27.467
11	36.45	1.35	229.517	2.121	4.295	191.722	3.588	27.454
15	36.32	1.48	229.904	2.332	4.260	191.842	3.648	27.441
19	36.20	1.61	230.302	2.546	4.224	191.963	3.708	27.428
23	36.09	1.74	230.709	2.765	4.187	192.083	3.768	27.415
			415					
27	36.00	1.88	231.124	-2.986	+4.149	192.204	-3.828	+27.402
Mar. 3	35.92	2.01	231.547	3.210	4.111	192.324	3.888	27.388
7	35.86	2.15	231.977	3.436	4.071	192.445	3.948	27.374
11	35.81	2.29	232.411	3.664	4.031	192.566	4.008	27.361
15	35.77	2.43	232.850	3.892	3.990	192.686	4.068	27.347
			442					
19	35.75	2.57	233.292	-4.120	+3.949	192.807	-4.127	+27.333
23	35.74	2.71	233.735	4.348	3.908	192.928	4.187	27.318
27	35.75	2.85	234.180	4.575	3.866	193.049	4.247	27.304
31	35.76	2.99	234.624	4.800	3.824	193.170	4.307	27.290
Apr. 4	35.80	3.13	235.067	5.024	3.782	193.290	4.367	27.275
			441					
8	35.84	3.28	235.508	-5.244	+3.740	193.411	-4.427	+27.260
12	35.90	3.42	235.946	5.462	3.698	193.532	4.487	27.245
16	35.97	3.56	236.380	5.676	3.657	193.654	4.546	27.230
20	36.06	3.70	236.809	5.885	3.615	193.775	4.606	27.215
24	36.16	3.84	237.230	6.090	3.575	193.896	4.666	27.200
			415					
28	36.27	3.97	237.645	-6.290	+3.534	194.017	-4.726	+27.184
May 2	36.39	4.11	238.052	6.484	3.495	194.138	4.786	27.169
6	36.53	4.24	238.449	6.672	3.456	194.260	4.846	27.153
10	36.68	4.38	238.836	6.853	3.418	194.381	4.906	27.137
14	36.84	4.51	239.211	7.028	3.381	194.502	4.965	27.121
			363					
18	37.01	4.64	239.574	-7.194	+3.345	194.624	-5.025	+27.105
22	37.20	4.76	239.924	7.353	3.310	194.746	5.085	27.089
26	37.39	4.88	240.259	7.504	3.277	194.867	5.145	27.072
30	37.60	5.00	240.579	7.646	3.245	194.989	5.205	27.056
June 3	37.82	5.12	240.883	7.779	3.215	195.110	5.264	27.039
			287					
7	38.04	5.23	241.170	-7.902	+3.186	195.232	-5.324	+27.022
11	38.28	5.34	241.438	8.016	3.159	195.354	5.384	27.005
15	38.53	5.44	241.688	8.119	3.134	195.476	5.444	26.988
19	38.78	5.54	241.917	8.212	3.111	195.598	5.503	26.971
23	39.04	5.63	242.126	8.294	3.090	195.720	5.563	26.954
			187					
27	39.31	5.72	242.313	-8.366	+3.071	195.842	-5.623	+26.936
July 1	39.58	5.80	242.479	-8.426	+3.054	195.964	-5.683	+26.919
			+166					

Factor by which axes of outer edge of outer ring are to be multiplied to obtain axes of:

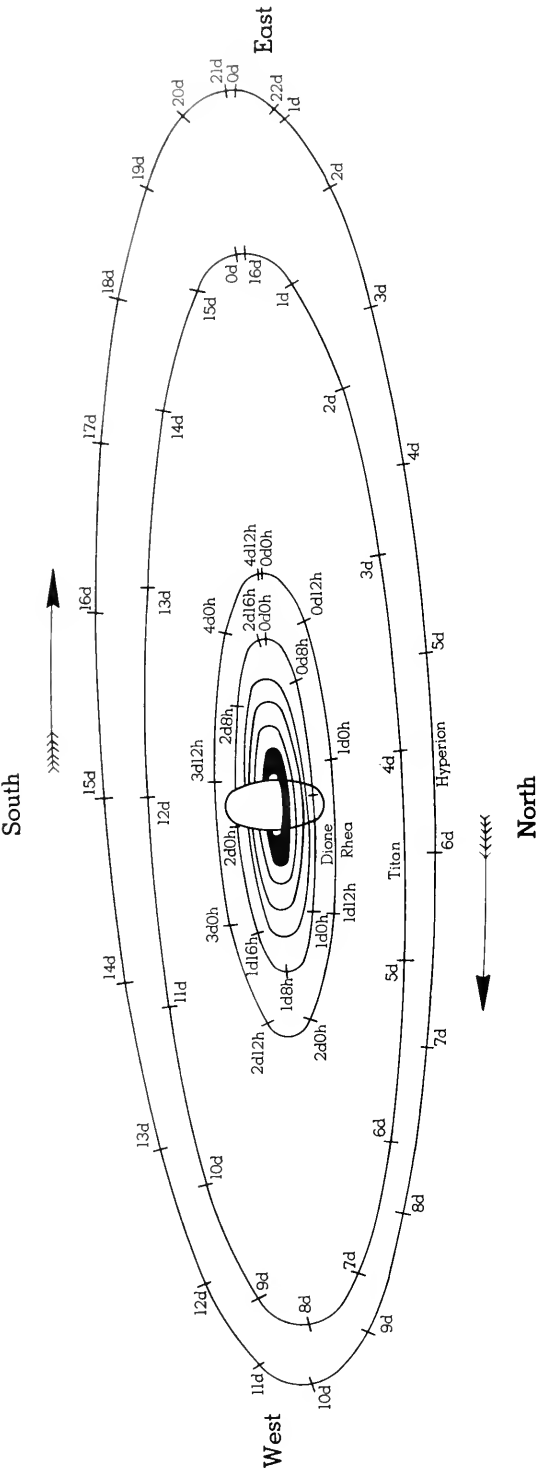
Inner edge of outer ring 0.8801
Inner edge of inner ring 0.6650
Outer edge of inner ring 0.8599
Inner edge of dusky ring 0.5486

FOR 0^h UNIVERSAL TIME

Date		Axes of outer edge of outer ring		U	B	P	U'	B'	P'
		Major	Minor						
July	1	"	"	°	°	°	°	°	°
	5	39.58	5.80	242.479	-8.426	+3.054	195.964	-5.683	+26.919
	9	39.86	5.87	242.621 ⁺¹⁴²	8.474	3.039	196.086	5.742	26.901
	13	40.15	5.94	242.740 ¹¹⁹	8.511	3.027	196.208	5.802	26.883
	17	40.43	6.00	242.835 ⁹⁵	8.536	3.017	196.331	5.862	26.865
	21	40.72	6.05	242.906 ⁷¹	8.549	3.010	196.453	5.921	26.847
	25								
	29	41.01	6.10	242.952	-8.551	+3.005	196.575	-5.981	+26.828
	Aug. 2	41.29	6.13	242.973 ^{+ 21}	8.540	3.003	196.698	6.041	26.810
	6	41.58	6.16	242.969 ^{- 4}	8.518	3.003	196.820	6.100	26.791
	10	41.86	6.18	242.941 ²⁸	8.484	3.006	196.943	6.160	26.773
	14	42.13	6.18	242.888 ⁵³	8.439	3.012	197.065	6.219	26.754
	18								
	22	42.40	6.18	242.810 ⁷⁸	-8.382	+3.019	197.188	-6.279	+26.735
	26	42.66	6.17	242.709 ⁻¹⁰¹	8.315	3.030	197.311	6.339	26.716
	30	42.90	6.15	242.584 ¹²⁵	8.237	3.042	197.434	6.398	26.696
	Sept. 3	43.14	6.11	242.438 ¹⁴⁶	8.150	3.057	197.556	6.458	26.677
	7	43.36	6.07	242.271 ¹⁶⁷	8.053	3.074	197.679	6.517	26.657
	11								
	15	43.56	6.02	242.084 ¹⁸⁷	-7.947	+3.093	197.802	-6.577	+26.638
	19	43.74	5.96	241.878 ⁻²⁰⁶	7.833	3.113	197.925	6.636	26.618
	23	43.91	5.89	241.655 ²²³	7.712	3.136	198.049	6.696	26.598
	27	44.06	5.82	241.418 ²³⁷	7.585	3.160	198.172	6.755	26.578
	Oct. 1	44.18	5.73	241.167 ²⁵¹	7.453	3.185	198.295	6.815	26.557
	5								
	9	44.28	5.64	240.906 ²⁶¹	-7.317	+3.211	198.418	-6.874	+26.537
	13	44.36	5.54	240.636 ⁻²⁷⁰	7.178	3.238	198.541	6.934	26.516
	17	44.41	5.44	240.359 ²⁷⁷	7.038	3.266	198.665	6.993	26.496
	21	44.43	5.34	240.078 ²⁸¹	6.896	3.294	198.788	7.052	26.475
	25	44.43	5.23	239.795 ²⁸³	6.755	3.322	198.912	7.112	26.454
	29								
	Sept. 3	44.41	5.12	239.512 ²⁸³	-6.616	+3.350	199.035	-7.171	+26.433
	7	44.36	5.01	239.234 ⁻²⁷⁸	6.479	3.377	199.159	7.230	26.412
	11	44.28	4.90	238.961 ²⁷³	6.348	3.404	199.283	7.290	26.390
	15	44.18	4.79	238.696 ²⁶⁵	6.221	3.430	199.407	7.349	26.369
	19	44.05	4.68	238.441 ²⁵⁵	6.101	3.455	199.530	7.408	26.347
	23								
	27	43.90	4.58	238.198 ²⁴³	-5.989	+3.479	199.654	-7.468	+26.325
	Oct. 1	43.74	4.48	237.970 ⁻²²⁸	5.885	3.501	199.778	7.527	26.303
	5	43.55	4.39	237.759 ²¹¹	5.791	3.522	199.902	7.586	26.281
	9	43.34	4.31	237.566 ¹⁹³	5.707	3.541	200.026	7.645	26.259
	13	43.12	4.23	237.393 ¹⁷³	5.634	3.557	200.151	7.705	26.237
	17								
	21	42.88	4.16	237.242 ⁻¹²⁹	-5.573	+3.572	200.275	-7.764	+26.214
	25	42.63	4.10	237.113 ¹⁰⁶	5.524	3.585	200.399	7.823	26.191
	29	42.37	4.05	237.007 ⁸¹	5.487	3.595	200.524	7.882	26.169
	Nov. 3	42.09	4.01	236.926 ⁵⁶	5.464	3.603	200.648	7.941	26.146
	7	41.82	3.97	236.870 ³⁰	5.453	3.608	200.772	8.000	26.123
	11								
	15	41.53	3.95	236.840 ^{- 5}	-5.457	+3.611	200.897	-8.059	+26.099
	19	41.25	3.93	236.835 ^{+ 22}	5.473	3.611	201.022	8.118	26.076
	23	40.96	3.93	236.857 ⁴⁸	5.503	3.609	201.146	8.177	26.053
	27	40.67	3.93	236.905 ⁷³	5.546	3.605	201.271	8.236	26.029
	31	40.38	3.94	236.978 ¹⁰⁰	5.602	3.597	201.396	8.295	26.005
	Dec. 5								
	9	40.09	3.96	237.078 ⁺¹²⁴	-5.671	+3.588	201.521	-8.354	+25.981
	13	39.81	3.99	237.202	-5.753	+3.576	201.646	-8.413	+25.957

Factor by which axes of outer edge of outer ring are to be multiplied to obtain axes of:

Inner edge of outer ring	0.8801	Inner edge of inner ring	0.6650
Outer edge of inner ring	0.8599	Inner edge of dusky ring	0.5486



APPARENT ORBITS OF THE SEVEN INNER SATELLITES, AT DATE OF
OPPOSITION, OCTOBER 2
ELONGATED IN THE RATIO OF TWO TO ONE IN THE DIRECTION
OF THEIR MINOR AXES

NAME	MEAN SYNODIC PERIOD		NAME	MEAN SYNODIC PERIOD	
	d	h		d	h
I Mimas	0	22.6	VI Titan	15	23.3
II Enceladus	1	08.9	VII Hyperion	21	07.6
III Tethys	1	21.3	VIII Iapetus	79	22.1
IV Dione	2	17.7	IX Phœbe	523	15.6
V Rhea	4	12.5			

UNIVERSAL TIME OF GREATEST EASTERN ELONGATION

Jan.	Feb.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
MIMAS										
d h 1 10.8 2 09.4 3 08.0 4 06.6 5 05.2	d h 1 13.3 2 12.0 3 10.6 4 09.2 5 07.8	d h	d h 1 04.0 2 02.6 3 01.2 3 23.9 4 22.5	d h 1 06.5 2 05.1 3 03.7 4 02.3 5 01.0	d h 1 10.3 2 08.9 3 07.5 4 06.1 5 04.8	d h 1 12.6 2 11.2 3 09.9 4 08.5 5 07.1	d h 1 14.9 2 13.5 3 12.1 4 10.7 5 09.3	d h 1 18.5 2 17.1 3 15.7 4 14.4 5 13.0	d h 1 20.8 2 19.4 3 18.0 4 16.6 5 15.2	d h 1 01.9 2 00.5 2 23.1 3 21.8 4 20.4
6 03.9 7 02.5 8 01.1 8 23.7 9 22.4	6 06.5 7 05.1 8 03.7 9 02.3 10 00.9	... .. ... .. ... .. ... .. ... ..	5 21.1 6 19.7 7 18.3 8 17.0 9 15.6	5 23.6 6 22.2 7 20.8 8 19.4 9 18.1	6 03.4 7 02.0 8 00.6 8 23.2 9 21.8	6 05.7 7 04.3 8 02.9 9 01.5 10 00.2	6 08.0 7 06.6 8 05.2 9 03.8 10 02.4	6 11.6 7 10.2 8 08.8 9 07.4 10 06.0	6 13.9 7 12.5 8 11.1 9 09.7 10 08.3	5 19.0 6 17.6 7 16.2 8 14.9 9 13.5
10 21.0 11 19.6 12 18.2 13 16.9 14 15.5	10 23.6 11 22.2 12 20.8 13 19.4 14 18.1	... .. ... .. ... .. ... .. ... ..	10 14.2 11 12.8 12 11.4 13 10.1 14 08.7	10 16.7 11 15.3 12 13.9 13 12.5 14 11.2	10 20.5 11 19.1 12 17.7 13 16.3 14 14.9	10 22.8 11 21.4 12 20.0 13 18.6 14 17.2	11 01.0 11 23.6 12 22.3 13 20.9 14 19.5	11 04.6 12 03.3 13 01.9 14 00.5 15 23.1	11 06.9 12 05.6 13 04.2 14 02.8 15 01.4	10 12.1 11 10.7 12 09.3 13 08.0 14 06.6
15 14.1 16 12.7 17 11.3 18 10.0 19 08.6	15 16.7 16 15.3 ... .. ... .. ... ..	... .. ... .. ... .. ... .. ... ..	15 07.3 16 05.9 17 04.6 18 03.2 19 01.8	15 09.8 16 08.4 17 07.0 18 05.6 19 04.3	15 13.5 16 12.2 17 10.8 18 09.4 19 08.0	15 15.8 16 14.5 17 13.1 18 11.7 19 10.3	15 18.1 16 16.7 17 15.3 18 13.9 19 12.5	15 21.7 16 20.3 17 18.9 18 17.6 19 16.2	16 00.0 16 22.6 17 21.3 18 19.9 19 18.5	15 05.2 16 03.8 17 02.4 18 01.1 19 23.7
20 07.2 21 05.8 22 04.5 23 03.1 24 01.7	... .. ... .. ... .. ... .. ... ..	... .. ... .. ... .. ... .. ... ..	20 00.4 20 23.0 21 21.7 22 20.3 23 18.9	20 02.9 21 01.5 22 00.1 23 22.7 24 21.3	20 06.6 21 05.2 22 03.9 23 02.5 24 01.1	20 08.9 21 07.5 22 06.1 23 04.8 24 03.4	20 11.2 21 09.8 22 08.4 23 07.0 24 05.6	20 14.8 21 13.4 22 12.0 23 10.6 24 09.2	20 17.1 21 15.7 22 14.3 23 13.0 24 11.6	19 22.3 20 20.9 21 19.5 22 18.2 23 16.8
25 00.3 26 21.6 27 20.2 28 18.8	... .. ... .. ... .. ... ..	... .. ... .. 27 09.5 28 08.1	24 17.5 25 16.1 26 14.8 27 13.4 28 12.0	24 20.0 25 18.6 26 17.2 27 15.8 28 14.4	24 23.7 25 22.3 26 20.9 27 19.6 28 18.2	25 02.0 26 00.6 26 23.2 27 21.8 28 20.4	25 04.2 26 02.8 27 01.4 28 00.1 29 22.7	25 07.9 26 06.5 27 05.1 28 03.7 29 02.3	25 10.2 26 08.8 27 07.4 28 06.1 29 04.7	24 15.4 25 14.0 26 12.6 27 11.3 28 09.9
29 17.5 30 16.1 31 14.7	... .. ... .. ... ..	29 06.7 30 05.4	29 10.6 30 09.2 31 07.9	29 13.1 30 11.7	29 16.8 30 15.4 31 14.0	29 19.1 30 17.7 31 16.3	29 21.3 30 19.9	30 00.9 30 23.6 31 22.2	30 03.3	29 08.5 30 07.1 31 05.8

TETHYS

d h 1 14.4 3 11.7 5 09.0 7 06.3 9 03.7	d h 2 16.9 4 14.3 6 11.6 8 08.9 10 06.3	d h	d h 2 11.6 4 08.9 6 06.2 8 03.6 10 00.9	d h 1 16.8 3 14.1 5 11.4 7 08.7 9 06.1	d h 1 21.8 3 19.2 5 16.5 7 13.8 9 11.1	d h 1 02.8 3 00.1 4 21.4 6 18.7 8 16.0	d h 2 04.8 4 02.1 5 23.4 7 20.7 9 18.0	d h 2 09.4 4 06.7 6 04.0 8 01.3 9 22.6	d h 1 14.1 3 11.4 5 08.7 7 06.0 9 03.3	d h 1 19.0 3 16.3 5 13.6 7 10.9 9 08.2
11 01.0 12 22.3 14 19.6 16 17.0 18 14.3	12 03.6 14 00.9 15 22.3 ... .. ... ..	... .. ... .. ... .. ... .. ... ..	11 22.2 13 19.5 15 16.9 17 14.2 19 11.5	11 03.4 13 00.7 14 22.0 16 19.3 18 16.6	11 08.4 13 05.7 15 03.0 17 00.3 18 21.6	10 13.3 12 10.5 14 07.8 16 05.1 18 02.4	11 15.3 13 12.5 15 09.8 17 07.1 19 04.4	11 19.9 13 17.2 15 14.5 17 11.8 19 09.1	11 00.6 12 21.9 14 19.2 16 16.5 18 13.8	11 05.5 13 02.8 15 00.1 16 21.5 18 18.8
20 11.6 22 08.9 24 06.3 26 03.6 28 00.9	... .. ... .. ... .. ... .. ... ..	... .. ... .. ... .. ... .. 28 16.9	21 08.8 23 06.2 25 03.5 27 00.8 28 22.1	20 14.0 22 11.3 24 08.6 26 05.9 28 03.2	20 18.9 22 16.2 24 13.5 26 10.8 28 08.1	19 23.7 21 21.0 23 18.3 25 15.6 27 12.9	21 01.7 22 23.0 24 20.3 26 17.6 28 14.9	21 06.4 23 03.7 25 01.0 26 22.2 28 19.5	20 11.1 22 08.4 24 05.7 26 03.0 28 00.4	20 16.1 22 13.4 24 10.7 26 08.0 28 05.4
29 22.3 31 19.6	... .. ... ..	30 14.2	30 19.5	30 00.5	30 05.4	29 10.2 31 07.5	30 12.2	30 16.8	29 21.7	30 02.7 32 00.0

UNIVERSAL TIME OF GREATEST EASTERN ELONGATION

Jan.	Feb.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
ENCELADUS										
d h	d h	d h	d h	d h	d h	d h	d h	d h	d h	d h
1 06.1	1 18.7	...	1 21.1	1 00.8	1 04.4	1 16.7	2 04.9	2 08.2	1 11.5	1 14.9
2 15.0	3 03.6	...	3 06.0	2 09.7	2 13.3	3 01.6	3 13.8	3 17.1	2 20.4	2 23.8
3 23.9	4 12.5	...	4 14.9	3 18.6	3 22.1	4 10.5	4 22.7	5 02.0	4 05.3	4 08.7
5 08.8	5 21.4	...	5 23.8	5 03.5	5 07.0	5 19.4	6 07.6	6 10.8	5 14.2	5 17.6
6 17.7	7 06.3	...	7 08.7	6 12.4	6 15.9	7 04.2	7 16.4	7 19.7	6 23.0	7 02.5
8 02.6	8 15.2	...	8 17.6	7 21.3	8 00.8	8 13.1	9 01.3	9 04.6	8 07.9	8 11.4
9 11.5	10 00.1	...	10 02.5	9 06.2	9 09.7	9 22.0	10 10.2	10 13.5	9 16.8	9 20.3
10 20.3	11 09.0	...	11 11.4	10 15.0	10 18.6	11 06.9	11 19.1	11 22.3	11 01.7	11 05.2
12 05.2	12 17.9	...	12 20.3	11 23.9	12 03.5	12 15.8	13 03.9	13 07.2	12 10.6	12 14.0
13 14.1	14 02.8	...	14 05.2	13 08.8	13 12.3	14 00.6	14 12.8	14 16.1	13 19.5	13 22.9
14 23.0	15 11.7	...	15 14.1	14 17.7	14 21.2	15 09.5	15 21.7	16 01.0	15 04.3	15 07.8
16 07.9	16 20.6	...	16 23.0	16 02.6	16 06.1	16 18.4	17 06.6	17 09.9	16 13.2	16 16.7
17 16.8	...	...	18 07.9	17 11.5	17 15.0	18 03.3	18 15.4	18 18.7	17 22.1	18 01.6
19 01.7	...	...	19 16.8	18 20.4	18 23.9	19 12.1	20 00.3	20 03.6	19 07.0	19 10.5
20 10.6	...	...	21 01.7	20 05.3	20 08.8	20 21.0	21 09.2	21 12.5	20 15.9	20 19.4
21 19.5	...	...	22 10.6	21 14.2	21 17.7	22 05.9	22 18.1	22 21.4	22 00.8	22 04.3
23 04.4	...	...	23 19.4	22 23.0	23 02.5	23 14.8	24 02.9	24 06.2	23 09.6	23 13.2
24 13.3	...	...	25 04.3	24 07.9	24 11.4	24 23.7	25 11.8	25 15.1	24 18.5	24 22.1
25 22.2	...	...	26 13.2	25 16.8	25 20.3	26 08.5	26 20.7	27 00.0	26 03.4	26 06.9
27 07.1	...	27 18.4	27 22.1	27 01.7	27 05.2	27 17.4	28 05.6	28 08.9	27 12.3	27 15.8
28 16.0	...	29 03.3	29 07.0	28 10.6	28 14.1	29 02.3	29 14.5	29 17.8	28 21.2	29 00.7
30 00.9	...	30 12.2	30 15.9	29 19.5	29 22.9	30 11.2	30 23.3	31 02.6	30 06.1	30 09.6
31 09.8	...	...	...	...	31 07.8	31 20.0	...	...	...	31 18.5

DIONE										
d h	d h	d h	d h	d h	d h	d h	d h	d h	d h	d h
2 05.6	1 08.6	...	2 18.0	1 21.0	1 23.8	1 02.3	2 22.3	3 00.5	2 02.7	2 05.1
4 23.3	4 02.3	...	5 11.7	4 14.7	4 17.4	3 20.0	5 15.9	5 18.1	4 20.3	4 22.8
7 17.0	6 20.1	...	8 05.4	7 08.4	7 11.1	6 13.7	8 09.6	8 11.8	7 14.0	7 16.4
10 10.8	9 13.8	...	10 23.2	10 02.1	10 04.8	9 07.3	11 03.3	11 05.4	10 07.7	10 10.1
13 04.5	12 07.5	...	13 16.9	12 19.8	12 22.5	12 01.0	13 20.9	13 23.1	13 01.3	13 03.8
15 22.2	15 01.3	...	16 10.6	15 13.5	15 16.2	14 18.7	16 14.6	16 16.7	15 19.0	15 21.5
18 15.9	...	...	19 04.4	18 07.2	18 09.9	17 12.3	19 08.2	19 10.4	18 12.7	18 15.2
21 09.7	...	...	21 22.1	21 00.9	21 03.6	20 06.0	22 01.9	22 04.0	21 06.3	21 08.9
24 03.4	...	...	24 15.8	23 18.6	23 21.3	22 23.7	24 19.5	24 21.7	24 00.0	24 02.6
26 21.1	...	27 06.5	27 09.5	26 12.4	26 15.0	25 17.3	27 13.2	27 15.3	26 17.7	26 20.3
29 14.9	...	30 00.2	30 03.2	29 06.1	29 08.6	28 11.0	30 06.8	30 09.0	29 11.4	29 14.0
...	...	...	...	...	...	31 04.6	...	...	...	...

RHEA										
d h	d h	d h	d h	d h	d h	d h	d h	d h	d h	d h
5 03.9	1 07.1	...	2 18.4	3 10.1	5 01.5	1 04.1	1 18.7	3 09.0	3 23.3	1 01.6
9 16.5	5 19.7	...	7 06.9	7 22.6	9 14.0	5 16.5	6 07.0	7 21.3	8 11.7	5 14.0
14 05.0	10 08.2	...	11 19.5	12 11.1	14 02.4	10 04.8	10 19.3	12 09.6	13 00.0	10 02.4
18 17.5	14 20.8	...	16 08.0	16 23.6	18 14.8	14 17.2	15 07.7	16 21.9	17 12.4	14 14.9
23 06.0	...	...	20 20.6	21 12.1	23 03.3	19 05.6	19 20.0	21 10.3	22 00.8	19 03.3
27 18.6	...	...	25 09.1	26 00.6	27 15.7	23 18.0	24 08.3	25 22.6	26 13.2	23 15.8
...	...	28 05.8	29 21.6	30 13.1	...	28 06.3	28 20.6	30 11.0	...	28 04.2

UNIVERSAL TIME OF CONJUNCTIONS AND ELONGATIONS

TITAN

Eastern Elongation			Inferior Conjunction			Western Elongation			Superior Conjunction		
d		h	Jan.	d	h	Jan.	d	h	Jan.	d	h
Jan.	13	08.4	Jan.	1	13.6	Jan.	5	14.0	Jan.	9	09.0
	29	08.4		17	13.4		21	13.8		25	08.9
Feb.	14	08.8	Feb.	2	13.6	Feb.	6	13.9	Feb.	10	09.1

	..	..		..	..	Apr.	27	16.1	May	1	11.3
May	5	11.7	May	9	16.9	May	13	16.4		17	11.5
	21	12.1		25	17.1		29	16.4	June	2	11.5
June	6	12.1	June	10	17.1	June	14	16.2		18	11.3
	22	11.8		26	16.7		30	15.7	July	4	10.7
July	8	11.2	July	12	16.0	July	16	14.8		20	09.7
	24	10.1		28	14.8	Aug.	1	13.5	Aug.	5	08.3
Aug.	9	08.6	Aug.	13	13.2		17	11.8		21	06.5
	25	06.7		29	11.2	Sept.	2	09.8	Sept.	6	04.4
Sept.	10	04.4	Sept.	14	08.8		18	07.5		22	02.1
	26	02.0		30	06.3	Oct.	4	05.1	Oct.	7	23.6
Oct.	11	23.4	Oct.	16	03.8		20	02.7		23	21.2
	27	21.0	Nov.	1	01.4	Nov.	5	00.4	Nov.	8	19.0
Nov.	12	18.8		16	23.3		20	22.4		24	17.1
	28	16.9	Dec.	2	21.6	Dec.	6	20.9	Dec.	10	15.6
Dec.	14	15.5		18	20.3		22	19.7		26	14.6
	30	14.6		34	19.5						

HYPERION

Eastern Elongation			Inferior Conjunction			Western Elongation			Superior Conjunction		
d		h	Jan.	d	h	Jan.	d	h	Jan.	d	h
Jan.	13	09.2	Jan.	19	16.1	Jan.	2	19.5	Jan.	7	06.6
Feb.	3	22.1	Feb.	10	04.0	Feb.	24	06.2		28	18.1
							14	17.4		..	..
May	1	03.6	May	7	03.3	May	11	13.8	May	16	06.9
	22	15.5		28	13.5	June	1	23.4	June	6	17.4
June	13	02.1	June	18	22.4		23	07.9		28	02.5
July	4	11.1	July	10	06.1	July	14	15.2	July	19	10.2
	25	18.4		31	12.2	Aug.	4	21.1	Aug.	9	16.3
Aug.	15	23.9	Aug.	21	17.0		26	01.8		30	20.9
Sept.	6	03.9	Sept.	11	20.5	Sept.	16	05.3	Sept.	21	00.3
	27	06.7	Oct.	2	23.2	Oct.	7	08.1	Oct.	12	02.9
Oct.	18	08.9		24	01.5		28	10.7	Nov.	2	05.5
Nov.	8	11.4	Nov.	14	04.1	Nov.	18	13.4		23	08.5
	29	14.5	Dec.	5	07.3	Dec.	9	16.7	Dec.	14	12.3
Dec.	20	18.8		26	11.3		30	20.9			

IAPETUS

Eastern Elongation			Inferior Conjunction			Western Elongation			Superior Conjunction		
d		h		d	h	Jan.	d	h	Jan.	d	h
Feb.	15	06.7		..	..	Jan.	7	05.7	Jan.	26	20.1
			
May	7	17.2	May	28	18.2		..	..		..	..
July	27	02.1	Aug.	16	14.7	June	18	14.3	July	7	20.1
Oct.	13	11.6	Nov.	2	17.5	Sept.	5	20.6	Sept.	24	15.5
Dec.	31	08.3				Nov.	23	01.6	Dec.	12	03.4

APPARENT DISTANCE AND POSITION ANGLE

Date (0 ^h U.T.)	Mimas		Enceladus		Tethys		Dione	
	$\frac{a}{\Delta}$	p_2	$\frac{a}{\Delta}$	p_2	$\frac{a}{\Delta}$	p_2	$\frac{a}{\Delta}$	p_2
	"	°	"	°	"	°	"	°
Jan. 0	26.3	+2.0	33.7	+1.6	41.7	+1.8	53.5	+1.6
5	26.1	1.8	33.4	1.5	41.4	1.8	53.0	1.5
10	25.9	1.6	33.2	1.5	41.1	1.8	52.6	1.5
15	25.7	1.5	32.9	1.5	40.8	1.8	52.2	1.5
20	25.5	1.3	32.7	1.5	40.5	1.8	51.9	1.4
25	25.3	+1.1	32.5	+1.4	40.2	+1.8	51.5	+1.4
May 10	25.0	-0.8	32.1	+0.4	39.7	+1.3	50.9	+0.4
15	25.1	0.7	32.3	0.4	39.9	1.2	51.1	0.4
20	25.3	0.7	32.4	0.3	40.2	1.2	51.4	0.3
25	25.5	-0.6	32.7	+0.3	40.4	+1.2	51.8	+0.3
30	25.6	0.5	32.9	0.2	40.7	1.2	52.1	0.2
June 4	25.8	0.5	33.1	0.2	41.0	1.1	52.5	0.2
9	26.0	0.4	33.4	0.2	41.3	1.1	52.9	0.2
14	26.2	0.3	33.6	0.1	41.6	1.1	53.3	0.1
19	26.4	-0.1	33.9	+0.1	42.0	+1.1	53.8	+0.1
24	26.7	0.0	34.2	+0.1	42.3	1.1	54.2	0.1
29	26.9	+0.1	34.5	0.0	42.7	1.0	54.7	+0.1
July 4	27.1	0.2	34.8	0.0	43.1	1.0	55.2	0.0
9	27.4	0.3	35.1	0.0	43.5	1.0	55.7	0.0
14	27.6	+0.4	35.4	0.0	43.9	+1.0	56.2	0.0
19	27.9	0.6	35.7	0.0	44.2	1.0	56.7	0.0
24	28.1	0.7	36.1	0.0	44.6	1.0	57.2	0.0
29	28.3	0.8	36.4	0.0	45.0	1.0	57.7	0.0
Aug. 3	28.5	0.9	36.7	0.0	45.4	1.0	58.1	0.0
8	28.8	+1.0	37.0	0.0	45.8	+1.1	58.6	0.0
13	29.0	1.1	37.3	0.0	46.1	1.1	59.1	0.0
18	29.2	1.2	37.5	0.0	46.5	1.1	59.5	0.0
23	29.4	1.3	37.7	0.0	46.8	1.1	59.9	+0.1
28	29.6	1.4	38.0	+0.1	47.1	1.1	60.3	0.1
Sept. 2	29.8	+1.5	38.2	+0.1	47.3	+1.2	60.6	+0.1
7	29.9	1.6	38.4	0.1	47.5	1.2	60.9	0.1
12	30.1	1.6	38.6	0.2	47.7	1.2	61.1	0.2
17	30.2	1.7	38.7	0.2	47.9	1.3	61.3	0.2
22	30.2	1.8	38.8	0.2	48.0	1.3	61.5	0.2
27	30.3	+1.8	38.8	+0.3	48.1	+1.3	61.6	+0.3
Oct. 2	30.3	1.8	38.9	0.3	48.1	1.4	61.6	0.3
7	30.3	1.9	38.9	0.3	48.1	1.4	61.6	0.3
12	30.2	1.9	38.8	0.4	48.0	1.5	61.5	0.4
17	30.2	1.9	38.7	0.4	47.9	1.5	61.4	0.4
22	30.1	+1.9	38.6	+0.4	47.8	+1.5	61.2	+0.4
27	30.0	1.8	38.5	0.5	47.6	1.6	61.0	0.5
Nov. 1	29.8	1.8	38.3	0.5	47.4	1.6	60.7	0.5
6	29.7	1.8	38.1	0.5	47.1	1.6	60.4	0.5
11	29.5	1.7	37.9	0.5	46.9	1.6	60.0	0.5
16	29.3	+1.7	37.6	+0.6	46.6	+1.7	59.6	+0.6
21	29.1	1.6	37.3	0.6	46.2	1.7	59.2	0.6
26	28.9	1.5	37.1	0.6	45.9	1.7	58.7	0.6
Dec. 1	28.7	1.3	36.8	0.6	45.5	1.7	58.3	0.6
6	28.4	1.2	36.4	0.6	45.1	1.7	57.8	0.6
11	28.2	+1.1	36.1	+0.6	44.7	+1.7	57.3	+0.6
16	27.9	1.0	35.8	0.6	44.3	1.7	56.8	0.6
21	27.7	0.9	35.5	0.6	44.0	1.7	56.3	0.6
26	27.4	0.7	35.2	0.6	43.6	1.7	55.8	0.6
31	27.2	0.6	34.9	0.6	43.2	1.7	55.3	0.6
36	27.0	+0.4	34.6	+0.6	42.8	+1.7	54.8	+0.6

APPARENT DISTANCE AND POSITION ANGLE

Time from Eastern Elongation	Mimas		Time from Eastern Elongation	Enceladus		Tethys		Time from Eastern Elongation	Dione	
	F	p_1		F	p_1	F	p_1		F	p_1
h		°	d h		°		°	d h		°
0.0	1.000	93.0	0 00	1.000	93.0	1.000	93.0	0 00	1.000	93.0
0.5	0.991	92.0	0 01	0.982	91.7	0.991	92.1	0 02	0.982	91.7
1.0	0.962	91.0	0 02	0.929	90.3	0.962	91.1	0 04	0.929	90.3
1.5	0.916	89.9	0 03	0.843	88.6	0.916	90.1	0 06	0.842	88.6
2.0	0.852	88.7	0 04	0.727	86.5	0.852	88.9	0 08	0.726	86.5
2.5	0.772	87.2	0 05	0.585	83.4	0.773	87.5	0 10	0.585	83.4
3.0	0.678	85.4	0 06	0.426	78.2	0.679	85.7	0 12	0.425	78.2
3.5	0.572	82.9	0 07	0.259	66.4	0.573	83.4	0 14	0.257	66.2
4.0	0.457	79.3	0 08	0.126	22.6	0.457	79.9	0 16	0.126	21.7
4.5	0.336	73.0	0 09	0.189	311.5	0.336	73.9	0 18	0.191	311.1
5.0	0.217	59.6	0 10	0.352	291.6	0.216	61.1	0 20	0.354	291.5
5.5	0.128	22.5	0 11	0.517	284.5	0.124	24.4	0 22	0.519	284.4
6.0	0.154	324.5	0 12	0.667	280.7	0.149	324.1	1 00	0.669	280.7
6.5	0.261	299.8	0 13	0.795	278.3	0.256	299.2	1 02	0.797	278.2
7.0	0.382	290.2	0 14	0.895	276.4	0.378	289.6	1 04	0.896	276.4
7.5	0.502	285.1	0 15	0.963	274.9	0.498	284.7	1 06	0.964	274.9
8.0	0.614	282.0	0 16	0.996	273.6	0.611	281.7	1 08	0.997	273.6
8.5	0.716	279.8	0 17	0.994	272.3	0.713	279.6	1 10	0.994	272.2
9.0	0.805	278.2	0 18	0.957	270.9	0.802	278.0	1 12	0.955	270.9
9.5	0.878	276.8	0 19	0.885	269.4	0.876	276.7	1 14	0.883	269.3
10.0	0.936	275.6	0 20	0.781	267.5	0.934	275.6	1 16	0.778	267.4
10.5	0.975	274.6	0 21	0.651	264.9	0.974	274.6	1 18	0.647	264.9
11.0	0.996	273.6	0 22	0.498	260.9	0.996	273.6	1 20	0.494	260.8
11.5	0.999	272.6	0 23	0.332	253.1	0.999	272.7	1 22	0.327	252.7
12.0	0.982	271.7	1 00	0.173	229.9	0.983	271.8	2 00	0.169	228.6
12.5	0.947	270.6	1 01	0.135	154.6	0.948	270.8	2 02	0.138	152.4
13.0	0.893	269.5	1 02	0.278	117.5	0.896	269.7	2 04	0.283	117.0
13.5	0.823	268.2	1 03	0.445	107.0	0.827	268.4	2 06	0.451	106.8
14.0	0.738	266.6	1 04	0.603	102.1	0.742	266.9	2 08	0.608	102.0
14.5	0.639	264.6	1 05	0.741	99.2	0.643	265.0	2 10	0.746	99.2
15.0	0.529	261.7	1 06	0.854	97.2	0.534	262.3	2 12	0.858	97.1
15.5	0.411	257.3	1 07	0.937	95.6	0.415	258.2	2 14	0.939	95.5
16.0	0.289	249.2	1 08	0.986	94.2	0.293	250.6	2 16	0.987	94.1
16.5	0.176	229.9	1 09	1.000	92.9	0.178	232.7	2 18	1.000	92.8
17.0	0.122	178.2	1 10	0.978	91.5	0.116	181.7	2 20	0.976	91.5
17.5	0.191	131.9	1 11			0.182	132.2			
18.0	0.307	115.2	1 12			0.298	115.0			
18.5	0.428	107.9	1 13			0.420	107.6			
19.0	0.546	103.8	1 14			0.538	103.5			
19.5	0.654	101.1	1 15			0.647	100.9			
20.0	0.751	99.1	1 16			0.745	99.0			
20.5	0.835	97.6	1 17			0.829	97.5			
21.0	0.902	96.3	1 18			0.898	96.3			
21.5	0.953	95.2	1 19			0.950	95.2			
22.0	0.986	94.2	1 20			0.984	94.2			
22.5	0.999	93.2	1 21			0.999	93.3			
23.0	0.994	92.3	1 22			0.995	92.4			

Apparent distance of satellite is $F \frac{a}{\Delta}$ Position angle of satellite is $p_1 + p_2$

APPARENT DISTANCE AND POSITION ANGLE

Date (0 ^h U.T.)		Rhea		Titan		Hyperion		Iapetus	
		$\frac{a}{\Delta}$	p_2	$\frac{a}{\Delta}$	p_2	$\frac{a}{\Delta}$	p_2	$\frac{a}{\Delta}$	p_2
		"	°	"	°	"	°	"	°
Jan.	0	74.7	+1.6	173	+1.2	209	+1.3	504	+2.4
	5	74.1	1.6	172	1.2	208	1.3	500	2.4
	10	73.5	1.5	170	1.2	206	1.3	496	2.3
	15	72.9	1.4	169	1.2	205	1.3	493	2.2
	20	72.4	1.4	168	1.1	203	1.2	489	2.1
May	25	71.9	+1.4	167	+1.1	202	+1.2	486	+2.0
	10	71.0	+0.3	165	+0.1	199	+0.1	480	-0.2
	15	71.4	0.2	165	0.0	200	0.0	482	0.3
	20	71.8	0.2	166	0.0	202	0.0	485	0.3
	25	72.3	+0.1	168	0.0	203	-0.1	488	-0.4
June	30	72.8	+0.1	169	-0.1	204	0.1	492	0.5
	4	73.3	0.0	170	0.1	206	0.2	495	0.6
	9	73.9	0.0	171	0.1	207	0.2	499	0.6
	14	74.5	0.0	173	0.2	209	0.2	503	0.7
	19	75.1	-0.1	174	-0.2	211	-0.3	507	-0.7
July	24	75.7	0.1	175	0.2	212	0.3	511	0.8
	29	76.4	0.1	177	0.3	214	0.3	516	0.8
	4	77.1	0.1	179	0.3	216	0.3	520	0.8
	9	77.7	0.2	180	0.3	218	0.4	525	0.9
	14	78.4	-0.2	182	-0.3	220	-0.4	530	-0.9
Aug.	19	79.1	0.2	183	0.3	222	0.4	534	0.9
	24	79.8	0.2	185	0.3	224	0.4	539	0.9
	29	80.5	0.2	187	0.3	226	0.4	544	0.9
	3	81.2	0.2	188	0.3	228	0.4	548	0.9
	8	81.8	-0.2	190	-0.3	230	-0.4	553	-0.9
Sept.	13	82.5	0.2	191	0.3	231	0.4	557	0.9
	18	83.1	0.1	193	0.3	233	0.3	561	0.8
	23	83.6	0.1	194	0.3	235	0.3	565	0.8
	28	84.1	0.1	195	0.2	236	0.3	568	0.8
	2	84.6	-0.1	196	-0.2	237	-0.3	571	-0.7
Oct.	7	85.0	0.0	197	0.2	239	0.2	574	0.7
	12	85.4	0.0	198	0.2	239	0.2	577	0.6
	17	85.7	0.0	198	0.1	240	0.2	578	0.6
	22	85.9	0.0	199	0.1	241	0.1	580	0.5
	27	86.0	+0.1	199	-0.1	241	-0.1	581	-0.4
Nov.	2	86.0	0.1	199	0.0	241	-0.1	581	0.4
	7	86.0	0.2	199	0.0	241	0.0	581	0.3
	12	85.9	0.2	199	0.0	241	0.0	580	0.3
	17	85.7	0.2	199	+0.1	241	0.0	579	0.2
	22	85.5	+0.3	198	+0.1	240	+0.1	577	-0.1
Dec.	27	85.2	0.3	197	0.1	239	0.1	575	-0.1
	1	84.8	0.3	196	0.2	238	0.1	573	0.0
	6	84.3	0.3	195	0.2	237	0.2	569	0.0
	11	83.8	0.4	194	0.2	235	0.2	566	+0.1
	16	83.3	+0.4	193	+0.2	234	+0.2	562	+0.1
	21	82.7	0.4	192	0.3	232	0.2	558	0.2
	26	82.0	0.4	190	0.3	230	0.2	554	0.2
	1	81.4	0.4	189	0.3	228	0.3	550	0.2
	6	80.7	0.4	187	0.3	226	0.3	545	0.2
	11	80.0	+0.4	185	+0.3	224	+0.3	540	+0.2
	16	79.3	0.4	184	0.3	222	0.3	536	0.2
	21	78.6	0.4	182	0.3	221	0.3	531	0.2
	26	77.9	0.4	181	0.3	219	0.2	526	0.2
	31	77.2	0.4	179	0.2	217	0.2	522	0.1
	36	76.6	+0.4	177	+0.2	215	+0.2	517	+0.1

APPARENT DISTANCE AND POSITION ANGLE

Time from Eastern Elongation	Rhea		Time from Eastern Elongation	Titan		Hyperion		Time from Eastern Elongation	Iapetus	
	F	p_1		F	p_1	F	p_1		F	p_1
d h		°	d h		°		°	d		°
0 00	1.000	93.0	0 00	1.022	93.0	1.103	93.0	0	1.001	79.0
0 03	0.985	91.8	0 10	1.013	91.9	1.092	92.3	2	0.993	77.3
0 06	0.941	90.4	0 20	0.978	90.8	1.069	91.5	4	0.962	75.6
0 09	0.869	88.9	1 06	0.919	89.6	1.033	90.7	6	0.908	73.7
0 12	0.772	87.1	1 16	0.839	88.1	0.986	89.8	8	0.834	71.5
0 15	0.652	84.6	2 02	0.738	86.4	0.926	88.8	10	0.741	68.8
0 18	0.515	80.9	2 12	0.620	83.9	0.855	87.7	12	0.633	65.3
0 21	0.366	74.3	2 22	0.488	80.3	0.773	86.4	14	0.513	60.2
1 00	0.217	58.6	3 08	0.347	73.7	0.682	84.7	16	0.389	51.8
1 03	0.125	5.8	3 18	0.209	58.3	0.582	82.4	18	0.270	35.7
1 06	0.207	309.4	4 04	0.121	8.3	0.474	79.2	20	0.194	2.3
1 09	0.355	292.3	4 14	0.191	311.4	0.362	74.0	22	0.218	318.9
1 12	0.505	285.4	5 00	0.327	293.4	0.250	64.1	24	0.318	294.0
1 15	0.643	281.6	5 10	0.467	286.1	0.152	40.0	26	0.441	282.1
1 18	0.764	279.1	5 20	0.600	282.2	0.126	346.0	28	0.564	275.4
1 21	0.863	277.2	6 06	0.718	279.6	0.202	308.3	30	0.679	271.1
2 00	0.937	275.7	6 16	0.817	277.7	0.311	294.1	32	0.781	268.0
2 03	0.983	274.3	7 02	0.895	276.2	0.422	287.3	34	0.866	265.5
2 06	1.000	273.1	7 12	0.948	274.9	0.529	283.3	36	0.932	263.4
2 09	0.987	271.8	7 22	0.974	273.7	0.627	280.6	38	0.976	261.6
2 12	0.945	270.5	8 08	0.973	272.5	0.712	278.6	40	0.997	259.9
2 15	0.875	269.0	8 18	0.945	271.3	0.783	277.0	42	0.993	258.2
2 18	0.780	267.2	9 04	0.889	269.9	0.838	275.6	44	0.965	256.5
2 21	0.661	264.8	9 14	0.808	268.4	0.875	274.4	46	0.914	254.6
3 00	0.525	261.2	10 00	0.703	266.5	0.893	273.3	48	0.840	252.5
3 03	0.376	255.0	10 10	0.580	263.8	0.893	272.2	50	0.745	249.8
3 06	0.227	240.3	10 20	0.442	259.4	0.874	271.0	52	0.632	246.3
3 09	0.126	191.3	11 06	0.294	250.9	0.838	269.6	54	0.506	241.1
3 12	0.198	131.5	11 16	0.159	226.4	0.785	268.4	56	0.373	232.3
3 15	0.344	113.0	12 02	0.130	156.5	0.718	266.9	58	0.249	214.2
3 18	0.495	105.8	12 12	0.250	120.0	0.638	264.9	60	0.179	173.7
3 21	0.634	101.8	12 22	0.397	108.8	0.548	262.4	62	0.230	129.0
4 00	0.756	99.2	13 08	0.540	103.6	0.449	258.7	64	0.350	108.0
4 03	0.857	97.3	13 18	0.671	100.6	0.346	253.0	66	0.483	98.1
4 06	0.933	95.8	14 04	0.785	98.5	0.245	242.4	68	0.611	92.5
4 09	0.981	94.4	14 14	0.879	96.9	0.158	218.7	70	0.726	88.8
4 12	1.000	93.2	15 00	0.951	95.5	0.133	171.2	72	0.825	86.0
4 15	0.989	91.9	15 10	0.998	94.4	0.196	134.8	74	0.903	83.8
			15 20	1.021	93.3	0.294	119.1	76	0.960	81.9
			16 06	1.011	91.9	0.398	111.5	78	0.992	80.1
			16 16			0.502	107.0	80	1.001	78.4
			17 02			0.601	104.1	82	0.985	76.8
			17 12			0.694	101.7			
			17 22			0.780	100.3			
			18 08			0.858	98.9			
			18 18			0.925	97.8			
			19 04			0.983	96.8			
			19 14			1.030	96.0			
			20 00			1.066	95.1			
			20 10			1.090	94.4			
			20 20			1.102	93.6			
			21 06			1.102	92.9			
			21 16			1.089	92.2			

Apparent distance of satellite is $F \frac{a}{\Delta}$ Position angle of satellite is $p_1 + p_2$

ORBITAL POSITIONS FOR 0^h UNIVERSAL TIME

Date	MIMAS			ENCELADUS		TETHYS		DIONE		
	<i>L</i>	<i>M</i>	θ	<i>L</i>	<i>M</i>	<i>L</i>	θ	<i>L</i>	<i>M</i>	
	°	°	°	°	°	°	°	°	°	
June	9	65.639	304.2	172.4	279.007	168.3	294.095	93.4	195.814	266.3
	14	175.660	49.2	167.4	152.661	40.3	167.582	92.4	133.488	203.6
	19	285.681	154.2	162.4	26.316	272.2	41.068	91.4	71.163	140.8
	24	35.702	259.3	157.4	259.970	144.2	274.555	90.5	8.837	78.1
	29	145.723	4.3	152.4	133.624	16.2	148.042	89.5	306.512	15.3
July	4	255.745	109.3	147.4	7.279	248.1	21.529	88.5	244.186	312.6
	9	5.766	214.3	142.4	240.933	120.1	255.016	87.5	181.861	249.8
	14	115.787	319.3	137.4	114.588	352.1	128.503	86.5	119.536	187.1
	19	225.808	64.3	132.4	348.242	224.0	1.989	85.5	57.210	124.3
	24	335.830	169.4	127.4	221.897	96.0	235.476	84.5	354.885	61.6
Aug.	29	85.851	274.4	122.4	95.552	328.0	108.963	83.5	292.559	358.8
	3	195.872	19.4	117.4	329.206	199.9	342.450	82.5	230.234	296.1
	8	305.894	124.4	112.4	202.861	71.9	215.937	81.5	167.908	233.4
	13	55.915	229.4	107.4	76.516	303.9	89.424	80.6	105.583	170.6
	18	165.937	334.4	102.4	310.171	175.8	322.910	79.6	43.257	107.9
Sept.	23	275.958	79.5	97.4	183.826	47.8	196.397	78.6	340.932	45.1
	28	25.980	184.5	92.4	57.481	279.8	69.884	77.6	278.606	342.4
	2	136.001	289.5	87.4	291.136	151.7	303.371	76.6	216.281	279.6
	7	246.023	34.5	82.4	164.791	23.7	176.858	75.6	153.955	216.9
	12	356.045	139.5	77.4	38.446	255.7	50.344	74.6	91.630	154.1
Oct.	17	106.066	244.6	72.4	272.101	127.6	283.831	73.6	29.304	91.4
	22	216.088	349.6	67.4	145.756	359.6	157.318	72.6	326.979	28.6
	27	326.110	94.6	62.4	19.412	231.6	30.805	71.6	264.653	325.9
	2	76.132	199.6	57.4	253.067	103.5	264.292	70.7	202.328	263.2
	7	186.153	304.6	52.4	126.723	335.5	137.778	69.7	140.002	200.4
Nov.	12	296.175	49.6	47.4	0.378	207.5	11.265	68.7	77.677	137.7
	17	46.197	154.7	42.4	234.034	79.4	244.752	67.7	15.351	74.9
	22	156.219	259.7	37.4	107.690	311.4	118.239	66.7	313.026	12.2
	27	266.241	4.7	32.4	341.346	183.4	351.726	65.7	250.700	309.4
	1	16.263	109.7	27.4	215.001	55.3	225.212	64.7	188.375	246.7
	6	126.285	214.7	22.4	88.657	287.3	98.699	63.7	126.049	183.9
	11	236.307	319.7	17.4	322.313	159.3	332.186	62.7	63.724	121.2
	16	346.329	64.8	12.4	195.970	31.2	205.673	61.8	1.398	58.4
	21	96.352	169.8	7.4	69.626	263.2	79.160	60.8	299.073	355.7
	26	206.374	274.8	2.4	303.282	135.2	312.646	59.8	236.747	292.9
Dec.	1	316.396	19.8	357.4	176.939	7.1	186.133	58.8	174.421	230.2
	6	66.418	124.8	352.4	50.595	239.1	59.620	57.8	112.096	167.5
	11	176.441	229.9	347.4	284.252	111.1	293.107	56.8	49.770	104.7
	16	286.463	334.9	342.4	157.908	343.0	166.594	55.8	347.445	42.0
	21	36.485	79.9	337.4	31.565	215.0	40.080	54.8	285.119	339.2
	26	146.508	184.9	332.4	265.222	87.0	273.567	53.8	222.793	276.5
	31	256.530	289.9	327.4	138.879	318.9	147.054	52.8	160.468	213.7
	36	6.553	34.9	322.4	12.536	190.9	20.540	51.9	98.142	151.0
	5 ^d motion	1910.022	1905.0	-5.0	1313.6..	1312.0	953.487	-1.0	657.675	657.3

ORBITAL POSITIONS FOR 0^h UNIVERSAL TIME

Date	RHEA				TITAN			
	<i>L</i>	<i>M</i>	θ	$\sin \gamma$	<i>L</i>	<i>M</i>	θ	$\sin \gamma$
	°	°	°		°	°	°	
June 9	60.032	214.4	302.3	0.00608	26.775	198.23	227.32	0.00563
14	98.482	252.8	302.2	.00608	139.659	311.11	227.32	.00563
19	136.932	291.3	302.1	.00608	252.544	63.99	227.31	.00563
24	175.382	329.8	301.9	.00608	5.428	176.86	227.31	.00563
29	213.832	8.2	301.8	.00608	118.312	289.74	227.30	.00563
July 4	252.282	46.7	301.6	0.00608	231.197	42.62	227.29	0.00563
9	290.731	85.1	301.5	.00608	344.081	155.50	227.29	.00563
14	329.181	123.6	301.4	.00609	96.966	268.38	227.28	.00563
19	7.631	162.1	301.2	.00609	209.850	21.25	227.28	.00564
24	46.081	200.5	301.1	.00609	322.735	134.13	227.27	.00564
29	84.531	239.0	301.0	0.00609	75.619	247.01	227.27	0.00564
Aug. 3	122.981	277.4	300.8	.00609	188.503	359.89	227.26	.00564
8	161.430	315.9	300.7	.00609	301.388	112.77	227.26	.00564
13	199.880	354.4	300.6	.00609	54.272	225.64	227.25	.00564
18	238.330	32.8	300.4	.00609	167.156	338.52	227.25	.00564
23	276.780	71.3	300.3	0.00610	280.041	91.40	227.24	0.00564
28	315.230	109.8	300.1	.00610	32.925	204.28	227.24	.00564
Sept. 2	353.680	148.2	300.0	.00610	145.810	317.16	227.23	.00564
7	32.129	186.7	299.9	.00610	258.694	70.04	227.23	.00564
12	70.579	225.1	299.7	.00610	11.579	182.91	227.22	.00565
17	109.029	263.6	299.6	0.00610	124.463	295.79	227.22	0.00565
22	147.479	302.1	299.5	.00610	237.348	48.67	227.21	.00565
27	185.929	340.5	299.3	.00610	350.232	161.55	227.21	.00565
Oct. 2	224.379	19.0	299.2	.00611	103.116	274.43	227.20	.00565
7	262.828	57.4	299.1	.00611	216.001	27.31	227.20	.00565
12	301.278	95.9	298.9	0.00611	328.885	140.18	227.20	0.00565
17	339.728	134.4	298.8	.00611	81.770	253.06	227.19	.00565
22	18.178	172.8	298.6	.00611	194.654	5.94	227.19	.00565
27	56.628	211.3	298.5	.00611	307.538	118.82	227.18	.00566
Nov. 1	95.078	249.8	298.4	.00611	60.423	231.70	227.18	.00566
6	133.527	288.2	298.2	0.00611	173.307	344.58	227.17	0.00566
11	171.977	326.7	298.1	.00612	286.192	97.45	227.17	.00566
16	210.427	5.1	298.0	.00612	39.076	210.33	227.16	.00566
21	248.877	43.6	297.8	.00612	151.961	323.21	227.16	.00566
26	287.327	82.1	297.7	.00612	264.845	76.09	227.16	.00566
Dec. 1	325.777	120.5	297.6	0.00612	17.729	188.97	227.15	0.00566
6	4.226	159.0	297.4	.00612	130.614	301.85	227.15	.00566
11	42.676	197.5	297.3	.00612	243.498	54.72	227.14	.00566
16	81.126	235.9	297.1	.00612	356.382	167.60	227.14	.00567
21	119.576	274.4	297.0	.00613	109.267	280.48	227.14	.00567
26	158.026	312.8	296.9	0.00613	222.151	33.36	227.13	0.00567
31	196.476	351.3	296.7	.00613	335.035	146.24	227.13	.00567
36	234.925	29.8	296.6	0.00613	87.920	259.11	227.12	0.00567
5 ^d motion	398.450	398.5	-0.01	. . . . .	112.884	112.88	0.00	. . . . .

ORBITAL POSITIONS FOR 0^h UNIVERSAL TIME

Date	HYPERION						IAPETUS		
	<i>L</i>	<i>M</i>	θ	γ	<i>e</i>	<i>a</i>	<i>L</i>	<i>M</i>	sin γ
	°	°	°	°		''	°	°	
June 9	267.460	131.34	290.69	0.569	0.11652	2046.1	114.377	234.89	0.25831
14	351.948	216.04	290.67	.569	.11624	2045.7	137.067	257.58	.25831
19	76.457	300.77	290.65	.569	.11596	2045.4	159.756	280.27	.25831
24	160.988	25.53	290.63	.569	.11567	2045.0	182.445	302.96	.25832
29	245.541	110.30	290.60	.570	.11539	2044.7	205.135	325.65	.25832
July 4	330.115	195.10	290.58	0.570	0.11510	2044.3	227.824	348.33	0.25832
9	54.711	279.92	290.56	.570	.11482	2044.0	250.514	11.02	.25833
14	139.329	4.77	290.54	.570	.11453	2043.6	273.203	33.71	.25833
19	223.969	89.64	290.52	.571	.11425	2043.3	295.892	56.40	.25833
24	308.631	174.53	290.49	.571	.11396	2043.0	318.582	79.09	.25834
29	33.314	259.44	290.47	0.571	0.11368	2042.6	341.271	101.78	0.25834
Aug. 3	118.018	344.38	290.45	.571	.11340	2042.3	3.961	124.46	.25834
8	202.743	69.34	290.43	.572	.11312	2042.0	26.650	147.15	.25834
13	287.490	154.33	290.41	.572	.11285	2041.6	49.339	169.84	.25835
18	12.256	239.32	290.38	.572	.11258	2041.3	72.029	192.53	.25835
23	97.043	324.35	290.36	0.572	0.11231	2041.0	94.718	215.22	0.25835
28	181.850	49.39	290.34	.573	.11205	2040.7	117.407	237.90	.25836
Sept. 2	266.675	134.45	290.32	.573	.11179	2040.4	140.097	260.59	.25836
7	351.519	219.54	290.30	.573	.11154	2040.1	162.786	283.28	.25836
12	76.381	304.65	290.28	.574	.11129	2039.9	185.476	305.97	.25837
17	161.260	29.77	290.25	0.574	0.11105	2039.6	208.165	328.66	0.25837
22	246.156	114.91	290.23	.574	.11082	2039.3	230.854	351.34	.25837
27	331.068	200.07	290.21	.574	.11059	2039.1	253.544	14.03	.25838
Oct. 2	55.995	285.24	290.19	.575	.11037	2038.9	276.233	36.72	.25838
7	140.937	10.43	290.17	.575	.11015	2038.7	298.923	59.41	.25838
12	225.892	95.63	290.14	0.575	0.10995	2038.5	321.612	82.10	0.25839
17	310.860	180.85	290.12	.575	.10975	2038.3	344.301	104.79	.25839
22	35.839	266.08	290.10	.576	.10956	2038.1	6.991	127.47	.25839
27	120.830	351.32	290.08	.576	.10937	2038.0	29.680	150.16	.25840
Nov. 1	205.831	76.57	290.06	.576	.10920	2037.8	52.370	172.85	.25840
6	290.841	161.83	290.03	0.576	0.10904	2037.7	75.059	195.54	0.25840
11	15.858	247.10	290.01	.577	.10888	2037.6	97.748	218.23	.25841
16	100.883	332.38	289.99	.577	.10873	2037.5	120.438	240.91	.25841
21	185.914	57.67	289.97	.577	.10859	2037.4	143.127	263.60	.25841
26	270.950	142.96	289.95	.577	.10846	2037.4	165.816	286.29	.25842
Dec. 1	355.990	228.25	289.93	0.578	0.10834	2037.3	188.506	308.98	0.25842
6	81.033	313.55	289.91	.578	.10823	2037.3	211.195	331.67	.25842
11	166.078	38.85	289.88	.578	.10813	2037.3	233.885	354.35	.25843
16	251.123	124.15	289.86	.579	.10804	2037.3	256.574	17.04	.25843
21	336.169	209.45	289.84	.579	.10795	2037.3	279.263	39.73	.25843
26	61.213	294.75	289.82	0.579	0.10788	2037.4	301.953	62.42	0.25844
31	146.254	20.05	289.80	.579	.10782	2037.4	324.642	85.11	.25844
36	231.292	105.34	289.77	0.580	0.10776	2037.5	347.332	107.80	0.25844
5 ^d motion	... ..	... ..	... ..	... ..	... ..	... ..	22.689	22.69	... ..

DIFFERENTIAL COORDINATES OF HYPERION FOR 0^h UNIVERSAL TIME

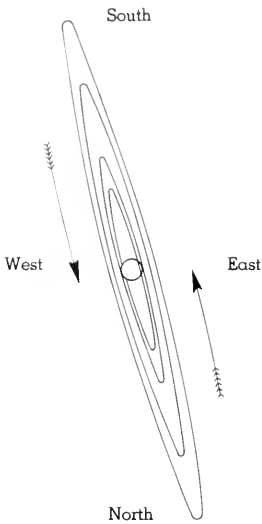
Date	$\alpha_H - \alpha_{Sat.}$	$\delta_H - \delta_{Sat.}$	Date	$\alpha_H - \alpha_{Sat.}$	$\delta_H - \delta_{Sat.}$	Date	$\alpha_H - \alpha_{Sat.}$	$\delta_H - \delta_{Sat.}$
Jan. 0	- 7 ^s	+0.2 [']	June 19	0 ^s	+0.5 [']	Sept. 25	+15 ^s	-0.5 [']
2	-12	+0.2	21	- 8	+0.5	27	+18	-0.3
4	-11	+0.2	23	-12	+0.2	29	+16	0.0
6	- 5	0.0	25	-11	-0.2	Oct. 1	+ 9	+0.3
8	+ 3	-0.1	27	- 5	-0.5	3	0	+0.5
10	+10	-0.2	29	+ 4	-0.6	5	- 9	+0.5
12	+14	-0.3	July 1	+11	-0.6	7	-14	+0.2
14	+15	-0.3	3	+15	-0.4	9	-12	-0.1
16	+12	-0.2	5	+16	-0.1	11	- 5	-0.4
18	+ 6	0.0	7	+13	+0.2	13	+ 4	-0.5
20	- 1	+0.1	9	+ 6	+0.5	15	+12	-0.5
22	- 8	+0.2	11	- 3	+0.6	17	+17	-0.4
24	-12	+0.2	13	-11	+0.4	19	+17	-0.2
26	-10	+0.1	15	-13	+0.1	21	+13	+0.1
28	- 3	-0.1	17	- 9	-0.3	23	+ 5	+0.4
30	+ 5	-0.2	19	- 2	-0.6	25	- 4	+0.5
Feb. 1	+11	-0.3	21	+ 6	-0.6	27	-12	+0.4
3	+15	-0.3	23	+13	-0.5	29	-14	+0.1
5	+14	-0.2	25	+16	-0.3	31	- 9	-0.2
7	+11	-0.1	27	+16	0.0	Nov. 2	- 1	-0.4
9	+ 5	+0.1	29	+11	+0.3	4	+ 8	-0.5
11	- 3	+0.2	31	+ 2	+0.5	6	+14	-0.5
13	-10	+0.3	Aug. 2	- 7	+0.5	8	+17	-0.3
Apr. 30	+14	-0.3	4	-13	+0.3	10	+16	-0.1
May 2	+14	-0.1	6	-13	-0.1	12	+10	+0.2
4	+11	+0.1	8	- 7	-0.4	14	+ 1	+0.4
6	+ 5	+0.3	10	+ 1	-0.6	16	- 8	+0.4
8	- 3	+0.4	12	+ 9	-0.6	18	-14	+0.3
10	-10	+0.3	14	+15	-0.5	20	-12	0.0
12	-12	+0.1	16	+17	-0.2	22	- 6	-0.3
14	- 8	-0.2	18	+15	+0.1	24	+ 3	-0.4
16	- 1	-0.4	20	+ 8	+0.4	26	+11	-0.5
18	+ 6	-0.5	22	- 1	+0.6	28	+16	-0.4
20	+12	-0.4	24	-10	+0.5	30	+17	-0.2
22	+15	-0.3	26	-14	+0.2	Dec. 2	+13	0.0
24	+14	0.0	28	-11	-0.2	4	+ 6	+0.3
26	+10	+0.2	30	- 4	-0.5	6	- 3	+0.4
28	+ 2	+0.4	Sept. 1	+ 5	-0.6	8	-11	+0.4
30	- 6	+0.5	3	+13	-0.6	10	-13	+0.2
June 1	-11	+0.3	5	+17	-0.4	12	-10	-0.1
3	-12	0.0	7	+17	-0.1	14	- 2	-0.4
5	- 7	-0.3	9	+13	+0.2	16	+ 6	-0.5
7	+ 1	-0.5	11	+ 4	+0.5	18	+13	-0.4
9	+ 8	-0.6	13	- 5	+0.5	20	+16	-0.3
11	+14	-0.4	15	-13	+0.4	22	+15	-0.1
13	+15	-0.2	17	-14	0.0	24	+10	+0.1
15	+14	+0.1	19	- 9	-0.3	26	+ 2	+0.3
17	+ 8	+0.4	21	0	-0.5	28	- 7	+0.4
19	0	+0.5	23	+ 9	-0.6	30	-12	+0.3
			25	+15	-0.5	32	-12	0.0

DIFFERENTIAL COORDINATES OF IAPETUS FOR 0^h UNIVERSAL TIME

Date	$\alpha_I - \alpha_{Sat}$	$\delta_I - \delta_{Sat}$	Date	$\alpha_I - \alpha_{Sat}$	$\delta_I - \delta_{Sat}$	Date	$\alpha_I - \alpha_{Sat}$	$\delta_I - \delta_{Sat}$
Jan. 0	-29 ^s	-0.5	June 19	-33 ^s	-1.8	Sept. 25	+2 ^s	-1.6
2	31	0.7	21	32	2.0	27	9	1.3
4	33	1.0	23	30	2.2	29	15	0.9
6	33	1.2	25	28	2.3	Oct. 1	20	0.5
8	33	1.3	27	25	2.4	3	25	-0.1
10	-32	-1.5	29	-21	-2.4	5	+29	+0.3
12	30	1.6	July 1	17	2.3	7	33	0.8
14	27	1.6	3	12	2.2	9	36	1.1
16	24	1.6	5	6	2.0	11	37	1.5
18	20	1.6	7	-1	1.8	13	38	1.8
20	-16	-1.6	9	+5	-1.5	15	+38	+2.1
22	11	1.5	11	10	1.1	17	36	2.3
24	7	1.3	13	15	0.8	19	34	2.4
26	-1	1.2	15	20	-0.4	21	31	2.5
28	+4	1.0	17	24	0.0	23	27	2.6
30	+9	-0.7	19	+28	+0.4	25	+23	+2.5
Feb. 1	13	0.5	21	31	0.8	27	18	2.4
3	18	-0.2	23	34	1.2	29	12	2.3
5	22	0.0	25	35	1.5	31	7	2.1
7	25	+0.3	27	35	1.9	Nov. 2	+1	1.8
9	+27	+0.6	29	+35	+2.1	4	-5	+1.5
11	29	0.8	31	34	2.3	6	11	1.2
13	+31	+1.0	Aug. 2	32	2.5	8	16	0.8
15	33	1.1	4	29	2.6	10	21	0.5
Apr. 30	+26	+0.4	6	25	2.7	12	26	+0.1
May 2	+28	+0.7	8	+21	+2.6	14	-29	-0.3
4	30	1.0	10	16	2.5	16	32	0.7
6	31	1.3	12	11	2.4	18	35	1.0
8	31	1.6	14	+6	2.2	20	36	1.3
10	31	1.8	16	0	1.9	22	37	1.6
12	+30	+2.0	18	-5	+1.6	24	-36	-1.8
14	28	2.1	20	11	1.3	26	35	2.0
16	25	2.2	22	16	0.9	28	32	2.2
18	22	2.2	24	21	0.5	30	29	2.3
20	19	2.2	26	26	+0.1	Dec. 2	26	2.3
22	+14	+2.2	28	-30	-0.3	4	-21	-2.2
24	10	2.1	30	33	0.7	6	16	2.1
26	5	1.9	Sept. 1	35	1.1	8	11	2.0
28	+1	1.7	3	37	1.5	10	-5	1.8
30	-4	1.4	5	37	1.8	12	+1	1.5
June 1	-9	+1.2	7	-37	-2.1	14	+6	-1.2
3	14	0.9	9	36	2.3	16	12	0.9
5	18	0.5	11	33	2.5	18	17	0.5
7	22	+0.2	13	30	2.5	20	22	-0.2
9	25	-0.2	15	26	2.6	22	26	+0.2
11	-28	-0.5	17	-21	-2.5	24	+29	+0.5
13	31	0.9	19	16	2.4	26	31	0.9
15	32	1.2	21	10	2.2	28	33	1.2
17	33	1.5	23	-4	2.0	30	34	1.5
19	-33	-1.8	25	+2	-1.6	32	+34	+1.7

DIFFERENTIAL COORDINATES OF PHOEBE FOR 0^h UNIVERSAL TIME

Date	$\alpha_{\text{Ph.}} - \alpha_{\text{Sat.}}$	$\delta_{\text{Ph.}} - \delta_{\text{Sat.}}$	Date	$\alpha_{\text{Ph.}} - \alpha_{\text{Sat.}}$	$\delta_{\text{Ph.}} - \delta_{\text{Sat.}}$	Date	$\alpha_{\text{Ph.}} - \alpha_{\text{Sat.}}$	$\delta_{\text{Ph.}} - \delta_{\text{Sat.}}$
Jan. 0	m s	'	June 19	m s	'	Sept. 25	m s	'
2	+0 25	+ 5.3	21	+1 58	+13.3	27	+0 36	+ 2.4
4	0 28	5.6	23	1 56	13.1	29	0 31	2.1
6	0 31	5.9	25	1 55	13.0	1	0 29	1.8
8	0 33	6.2	27	1 54	12.9	3	0 26	1.5
	0 36	6.4			12.7			1.2
10	+0 38	+ 6.7	29	+1 53	+12.6	5	+0 24	+ 0.9
12	0 41	7.0	July 1	1 52	12.4	7	0 21	0.6
14	0 43	7.3	3	1 51	12.3	9	0 19	+ 0.2
16	0 46	7.5	5	1 50	12.1	11	0 16	- 0.1
18	0 48	7.8	7	1 49	12.0	13	0 13	0.4
20	+0 51	+ 8.0	9	+1 48	+11.8	15	+0 11	- 0.7
22	0 53	8.3	11	1 47	11.6	17	0 08	1.0
24	0 55	8.5	13	1 46	11.5	19	0 06	1.3
26	0 58	8.8	15	1 44	11.3	21	0 03	1.6
28	1 00	9.0	17	1 43	11.1	23	+0 01	1.9
30	+1 02	+ 9.3	19	+1 42	+10.9	25	-0 02	- 2.2
Feb. 1	1 04	9.5	21	1 40	10.7	27	0 05	2.5
3	1 07	9.7	23	1 39	10.5	29	0 07	2.8
5	1 09	9.9	25	1 38	10.3	31	0 10	3.1
7	1 11	10.2	27	1 36	10.1	Nov. 2	0 12	3.4
9	+1 13	+10.4	29	+1 35	+ 9.9	4	-0 15	- 3.7
11	1 15	10.6	31	1 33	9.7	6	0 18	4.0
13	+1 17	+10.8	Aug. 2	1 31	9.5	8	0 20	4.3
..	..	..	4	1 30	9.3	10	0 23	4.6
Apr. 30	+2 03	+14.8	6	1 28	9.0	12	0 25	4.9
May 2	+2 03	+14.8	8	+1 26	+ 8.8	14	-0 28	- 5.2
4	2 03	14.8	10	1 25	8.6	16	0 30	5.5
6	2 04	14.8	12	1 23	8.4	18	0 33	5.7
8	2 04	14.8	14	1 21	8.1	20	0 35	6.0
10	2 04	14.7	16	1 19	7.9	22	0 38	6.3
12	+2 04	+14.7	18	+1 17	+ 7.6	24	-0 40	- 6.5
14	2 04	14.7	20	1 15	7.4	26	0 42	6.8
16	2 04	14.7	22	1 13	7.1	28	0 45	7.1
18	2 04	14.6	24	1 11	6.9	30	0 47	7.3
20	2 04	14.6	26	1 09	6.6	Dec. 2	0 49	7.5
22	+2 04	+14.5	28	+1 07	+ 6.3	4	-0 52	- 7.8
24	2 04	14.5	30	1 05	6.1	6	0 54	8.0
26	2 04	14.4	Sept. 1	1 03	5.8	8	0 56	8.2
28	2 03	14.3	3	1 01	5.5	10	0 58	8.4
30	2 03	14.3	5	0 59	5.3	12	1 00	8.6
June 1	+2 03	+14.2	7	+0 57	+ 5.0	14	-1 02	- 8.8
3	2 02	14.1	9	0 55	4.7	16	1 04	9.0
5	2 02	14.0	11	0 52	4.4	18	1 06	9.2
7	2 01	13.9	13	0 50	4.1	20	1 08	9.4
9	2 01	13.8	15	0 48	3.9	22	1 10	9.6
11	+2 00	+13.7	17	+0 45	+ 3.6	24	-1 11	- 9.7
13	2 00	13.6	19	0 43	3.3	26	1 13	9.9
15	1 59	13.5	21	0 41	3.0	28	1 15	10.0
17	1 58	13.4	23	0 38	2.7	30	1 16	10.1
19	+1 58	+13.3	25	+0 36	+ 2.4	32	-1 17	-10.3



NAME		SIDEREAL PERIOD	
		d	h
V	Miranda	1.4	
I	Ariel	2	12.489
II	Umbriel	4	03.460
III	Titania	8	16.941
IV	Oberon	13	11.118

APPARENT DISTANCE AND POSITION ANGLE

Date (0 ^h U.T.)		$\frac{a}{\Delta}$				p_2	Date (0 ^h U.T.)		$\frac{a}{\Delta}$				p_2
		Ariel	Umbriel	Titania	Oberon				Ariel	Umbriel	Titania	Oberon	
		"	"	"	"	°			"	"	"	"	°
Jan.	0	14.7	20.4	33.5	44.9	+0.5	June	9	14.5	20.2	33.2	44.4	+0.3
	10	14.8	20.6	33.9	45.3	0.5		19	14.4	20.0	32.9	44.0	0.3
	20	14.9	20.8	34.1	45.7	0.5		29	14.3	19.9	32.6	43.6	0.3
	30	15.0	21.0	34.4	46.0	0.5	July	9	14.1	19.7	32.3	43.2	0.3
Feb.	9	15.1	21.1	34.6	46.3	0.4		19	14.0	19.6	32.1	42.9	0.3
	19	15.2	21.2	34.8	46.5	+0.4		29	13.9	19.4	31.9	42.6	+0.3
Mar.	1	15.3	21.3	34.9	46.7	0.4		..	..	..	..	..	..
	11	15.3	21.3	34.9	46.7	0.4	Oct.	17	13.8	19.2	31.5	42.1	+0.5
	21	15.3	21.3	34.9	46.7	0.4		27	13.9	19.3	31.7	42.3	0.5
	31	15.3	21.3	34.9	46.6	0.3	Nov.	6	13.9	19.4	31.9	42.6	0.5
Apr.	10	15.2	21.2	34.7	46.5	+0.3		16	14.0	19.6	32.1	42.9	+0.5
	20	15.1	21.1	34.6	46.2	0.3		26	14.2	19.7	32.4	43.3	0.5
	30	15.0	20.9	34.3	45.9	0.3	Dec.	6	14.3	19.9	32.6	43.6	0.5
	10	14.9	20.8	34.1	45.6	0.3		16	14.4	20.1	32.9	44.0	0.5
May	20	14.8	20.6	33.8	45.2	0.3		26	14.5	20.3	33.2	44.4	0.5
	30	14.7	20.4	33.5	44.8	+0.3		36	14.7	20.4	33.5	44.9	+0.5

APPARENT DISTANCE AND POSITION ANGLE

Time from Northern Elongation	Ariel		Umbriel		Time from Northern Elongation	Titania		Time from Northern Elongation	Oberon	
	F	p_1	F	p_1		F	p_1		F	p_1
d h		°		°	d h		°	d h		°
0 00	1.000	15.0	1.000	15.0	0 00	1.000	15.0	0 00	1.000	15.0
0 02	0.979	16.1	0.992	15.7	0 05	0.989	15.8	0 08	0.988	15.8
0 04	0.916	17.3	0.969	16.3	0 10	0.955	16.6	0 16	0.952	16.7
0 06	0.814	18.7	0.930	17.0	0 15	0.901	17.5	1 00	0.894	17.6
0 08	0.677	20.6	0.876	17.8	0 20	0.826	18.5	1 08	0.814	18.7
0 10	0.513	23.7	0.809	18.8	1 01	0.733	19.8	1 16	0.715	20.1
0 12	0.330	30.0	0.729	19.9	1 06	0.624	21.5	2 00	0.600	21.9
0 14	0.147	52.5	0.637	21.3	1 11	0.502	24.0	2 08	0.470	24.7
0 16	0.128	150.5	0.537	23.2	1 16	0.369	28.1	2 16	0.332	29.9
0 18	0.307	178.7	0.428	26.0	1 21	0.233	37.1	3 00	0.191	42.5
0 20	0.492	185.8	0.314	30.8	2 02	0.112	68.2	3 08	0.091	95.4
0 22	0.659	189.1	0.200	41.2	2 07	0.122	147.8	3 16	0.166	162.5
1 00	0.799	191.1	0.105	73.7	2 12	0.247	174.3	4 00	0.304	178.6
1 02	0.905	192.6	0.115	143.6	2 17	0.384	182.5	4 08	0.444	184.5
1 04	0.973	193.8	0.216	170.9	2 22	0.515	186.4	4 16	0.575	187.6
1 06	1.000	194.9	0.330	180.0	3 03	0.636	188.7	5 00	0.694	189.6
1 08	0.984	195.9	0.443	184.5	3 08	0.744	190.3	5 08	0.796	191.1
1 10	0.925	197.1	0.551	187.1	3 13	0.835	191.6	5 16	0.880	192.2
1 12	0.828	198.5	0.650	188.9	3 18	0.908	192.6	6 00	0.943	193.2
1 14	0.696	200.3	0.740	190.3	3 23	0.960	193.5	6 08	0.983	194.0
1 16	0.535	203.2	0.819	191.4	4 04	0.991	194.3	6 16	1.000	194.8
1 18	0.353	208.8	0.884	192.3	4 09	1.000	195.1	7 00	0.992	195.6
1 20	0.167	227.2	0.936	193.1	4 14	0.986	195.9	7 08	0.961	196.5
1 22	0.111	321.3	0.973	193.8	4 19	0.951	196.7	7 16	0.907	197.4
2 00	0.284	257.2	0.994	194.4	5 00	0.894	197.6	8 00	0.831	198.5
2 02	0.470	5.2	1.000	195.1	5 05	0.817	198.7	8 08	0.736	199.8
2 04	0.640	8.8	0.990	195.7	5 10	0.722	200.0	8 16	0.623	201.5
2 06	0.783	10.9	0.964	196.4	5 15	0.612	201.7	9 00	0.496	204.1
2 08	0.894	12.4	0.923	197.2	5 20	0.488	204.4	9 08	0.359	208.6
2 10	0.967	13.6	0.868	198.0	6 01	0.355	208.7	9 16	0.218	218.8
2 12	0.999	14.7	0.799	198.9	6 06	0.219	218.7	10 00	0.100	258.0
2 14	0.988	15.8	0.717	200.0	6 11	0.103	255.2	10 08	0.141	335.9
2 16			0.624	201.5	6 16	0.133	332.9	10 16	0.276	356.7
2 18			0.522	203.5	6 21	0.262	355.6	11 00	0.417	3.7
2 20			0.413	206.5	7 02	0.398	3.0	11 08	0.550	7.1
2 22			0.299	211.7	7 07	0.528	6.7	11 16	0.672	9.3
3 00			0.186	223.5	7 12	0.648	8.9	12 00	0.778	10.8
3 02			0.097	262.3	7 17	0.754	10.5	12 08	0.865	12.0
3 04			0.126	329.7	7 22	0.844	11.7	12 16	0.932	13.0
3 06			0.231	352.6	8 03	0.914	12.7	13 00	0.977	13.9
3 08			0.346	0.8	8 08	0.964	13.6	13 08	0.998	14.7
3 10			0.458	4.9	8 13	0.993	14.4	13 16	0.996	15.5
3 12			0.565	7.4	8 18	1.000	15.2			
3 14			0.663	9.2						
3 16			0.752	10.5						
3 18			0.828	11.5						
3 20			0.892	12.4						
3 22			0.942	13.2						
4 00			0.976	13.9						
4 02			0.996	14.5						
4 04			0.999	15.2						

Apparent distance of satellite is $F \frac{a}{\Delta}$
Position angle of satellite is $p_1 + p_2$

UNIVERSAL TIME OF GREATEST NORTHERN ELONGATION

ARIEL

Jan.	d h -2 22.1 1 10.6 3 23.0 6 11.5 9 00.0	Feb.	d h 18 07.8 20 20.3 23 08.8 25 21.3 28 09.7	Apr.	d h 9 17.6 12 06.1 14 18.6 17 07.1 19 19.6	May	d h 30 03.5 June 1 16.0 4 04.5 6 17.0 9 05.5	July	d h 19 13.4 22 01.9 24 14.4 27 02.8 29 15.3	Nov.	d h 15 00.2 17 12.7 20 01.2 22 13.7 25 02.1
	11 12.5 14 01.0 16 13.5 19 02.0 21 14.4	Mar.	2 22.2 5 10.7 7 23.2 10 11.7 13 00.2		22 08.1 24 20.6 27 09.1 29 21.6 May 2 10.1		11 18.0 14 06.5 16 19.0 19 07.5 21 20.0	Aug.	1 03.8 3 16.3 6 04.8 8 17.3	Dec.	27 14.6 30 03.1 2 15.6 5 04.1 7 16.6
	24 02.9 26 15.4 29 03.9 31 16.4 Feb. 3 04.9		15 12.7 18 01.2 20 13.7 23 02.2 25 14.7		4 22.6 7 11.1 9 23.6 12 12.0 15 00.5	July	24 08.5 26 20.9 29 09.4 1 21.9 4 10.4	Oct.	20 19.4 23 07.9 25 20.4 28 08.9 30 21.3		10 05.0 12 17.5 15 06.0 17 18.5 20 07.0
	5 17.4 8 05.8 10 18.3 13 06.8 15 19.3	Apr.	28 03.2 30 15.7 2 04.1 4 16.6 7 05.1		17 13.0 20 01.5 22 14.0 25 02.5 27 15.0		6 22.9 9 11.4 11 23.9 14 12.4 17 00.9	Nov.	2 09.8 4 22.3 7 10.8 9 23.3 12 11.7		22 19.5 25 07.9 27 20.4 30 08.9 32 21.4

UMBRIEL

Jan.	d h -3 10.1 1 13.6 5 17.1 9 20.5 14 00.0 18 03.4	Feb.	d h 16 03.6 20 07.1 24 10.5 28 14.0 Mar. 4 17.5 8 20.9	Apr.	d h 6 21.2 11 00.7 15 04.1 19 07.6 23 11.1 27 14.6	May	d h 26 14.8 30 18.3 June 3 21.8 8 01.3 12 04.7 16 08.2	July	d h 15 08.4 19 11.9 23 15.4 27 18.8 31 22.3 Aug. 5 01.7	Nov.	d h 16 16.0 20 19.5 24 22.9 29 02.4 Dec. 3 05.8 7 09.2
	22 06.9 26 10.3 30 13.8 Feb. 03 17.2 07 20.7 12 00.2		13 00.4 17 03.9 21 07.3 25 10.8 29 14.3 Apr. 2 17.7	May	1 18.0 5 21.5 10 01.0 14 04.4 18 07.9 22 11.4	July	20 11.6 24 15.1 28 18.6 2 22.0 7 01.5 11 05.0	Oct.	26 22.8 31 02.2 Nov. 4 05.7 8 09.1 12 12.6		11 12.7 15 16.1 19 19.6 23 23.0 28 02.5 32 05.9

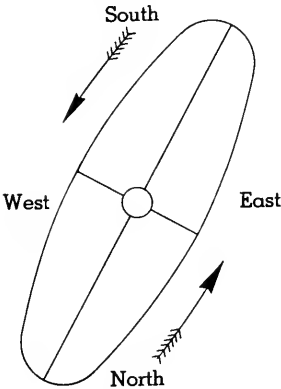
TITANIA

Jan.	d h -8 10.7 1 03.6 9 20.6 18 13.5 27 06.5 Feb. 4 23.4	Feb.	d h 13 16.3 22 09.3 Mar. 3 02.2 11 19.2 20 12.2 29 05.2	Apr.	d h 6 22.2 15 15.1 24 08.1 May 3 01.1 11 18.1 20 11.0	May	d h 29 04.0 June 6 20.9 15 13.9 24 06.8 July 2 23.8 11 16.7	July	d h 20 09.6 29 02.5 Aug. 6 19.5 Nov. 1 20.4 10 13.3	Nov.	d h 19 06.2 27 23.1 Dec. 6 16.0 15 08.9 23 25.9 32 18.8
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OBERON

Jan.	d h -5 08.7 8 19.8 22 06.9 Feb. 4 18.0	Feb.	d h 18 05.1 3 16.3 17 03.5 30 14.7	Apr.	d h 13 01.9 26 13.1 May 10 00.3 23 11.4	June	d h 5 22.6 19 09.7 July 2 20.8 16 07.9	July	d h 29 18.9 Nov. 1 00.1 14 11.1	Nov.	d h 27 22.1 Dec. 11 09.2 24 20.2 38 07.3
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APPARENT ORBIT OF TRITON AT DATE OF OPPOSITION, MAY 14



NAME	SIDEREAL PERIOD
I Triton	5 ^d 21 ^h .044
II Nereid	359 ^d .88

TRITON

UNIVERSAL TIME OF GREATEST EASTERN ELONGATION

	d	h		d	h		d	h		d	h		d	h
Jan. -	2	09.5	Feb.	20	06.5	Apr.	14	04.0	June	6	01.8	July	28	23.5
	4	06.5		26	03.6		20	01.1		11	22.9	Aug.	3	20.6
	10	03.5	Mar.	4	00.6		25	22.2		17	20.0		9	17.6
	16	00.5		9	21.6	May	1	19.3		23	17.1		15	14.7
	21	21.5		15	18.7		7	16.3		29	14.2		21	11.7
	27	18.5		21	15.7		13	13.4	July	5	11.2		27	08.8
Feb.	2	15.5		27	12.8		19	10.5		11	08.3	Sept.	2	05.8
	8	12.5	Apr.	2	09.9		25	07.6		17	05.4		8	02.8
	14	09.5		8	06.9		31	04.7		23	02.5		13	23.8
												Dec.	22	20.7
													28	17.6
													34	14.6

APPARENT DISTANCE AND POSITION ANGLE

Date (0 ^b U.T.)	$\frac{a}{\Delta}$	p_2	Date (0 ^b U.T.)	$\frac{a}{\Delta}$	p_2	Date (0 ^b U.T.)	$\frac{a}{\Delta}$	p_2	Date (0 ^b U.T.)	$\frac{a}{\Delta}$	p_2
Jan. -10	15.7	-0.2	Mar. 31	16.5	-0.6	July 9	16.5	+0.7	Oct. 17	15.7	0.0
10	15.9	0.5	Apr. 20	16.7	0.4	29	16.3	0.7	..	..	..
30	16.0	0.7	May 10	16.7	-0.1	Aug. 18	16.1	0.7	..	..	..
Feb. 19	16.2	0.8	30	16.7	+0.2	Sept. 7	16.0	0.6	Dec. 16	15.7	-1.2
Mar. 11	16.4	-0.8	June 19	16.6	+0.5	27	15.8	+0.4	36	15.8	-1.5

Time from Eastern Elongation	F	p_1	Time from Eastern Elongation	F	p_1	Time from Eastern Elongation	F	p_1	Time from Eastern Elongation	F	p_1
d h		°	d h		°	d h		°	d h		°
0 00	1.000	149.0	1 12	0.331	244.7	3 00	0.998	330.2	4 12	0.343	75.7
0 03	0.992	151.5	1 15	0.365	266.0	3 03	0.982	332.8	4 15	0.395	94.6
0 06	0.968	154.2	1 18	0.432	282.2	3 06	0.951	335.5	4 18	0.472	108.3
0 09	0.930	157.0	1 21	0.516	293.5	3 09	0.905	338.4	4 21	0.560	117.8
0 12	0.877	160.1	2 00	0.605	301.6	3 12	0.846	341.7	5 00	0.649	124.8
0 15	0.811	163.7	2 03	0.693	307.7	3 15	0.775	345.6	5 03	0.733	130.1
0 18	0.735	167.8	2 06	0.774	312.4	3 18	0.694	350.3	5 06	0.810	134.3
0 21	0.650	173.1	2 09	0.845	316.2	3 21	0.607	356.3	5 09	0.876	137.9
1 00	0.561	180.0	2 12	0.904	319.5	4 00	0.517	4.3	5 12	0.929	141.0
1 03	0.473	189.6	2 15	0.951	322.5	4 03	0.433	15.6	5 15	0.968	143.8
1 06	0.396	203.1	2 18	0.982	325.1	4 06	0.366	31.7	5 18	0.992	146.4
1 09	0.343	222.0	2 21	0.998	327.7	4 09	0.332	52.9	5 21	1.000	148.9

Apparent distance of satellite is $F \frac{a}{\Delta}$ Position angle of satellite is $p_1 + p_2$

384

SUNRISE AND TWILIGHT, 1967

LOCAL MEAN TIME OF SUNRISE AND BEGINNING OF ASTRONOMICAL TWILIGHT—MERIDIAN OF GREENWICH

Date \ Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
		SUNRISE (UPPER LIMB)												
Jan.	0	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
	5	5 59	6 16	6 35	6 56	7 08	7 22	7 38	7 59	8 08	8 19	8 32	8 46	9 03
	10	6 02	6 18	6 36	6 57	7 09	7 22	7 38	7 58	8 08	8 18	8 30	8 44	9 00
	15	6 04	6 20	6 37	6 57	7 09	7 22	7 37	7 56	8 05	8 15	8 27	8 40	8 55
	20	6 06	6 21	6 38	6 57	7 08	7 20	7 35	7 53	8 02	8 11	8 22	8 34	8 49
Feb.	25	6 07	6 22	6 38	6 56	7 06	7 18	7 32	7 49	7 57	8 06	8 16	8 27	8 41
	30	6 09	6 23	6 37	6 54	7 04	7 15	7 28	7 44	7 51	7 59	8 09	8 19	8 31
	4	6 10	6 23	6 36	6 52	7 01	7 11	7 23	7 38	7 44	7 52	8 00	8 09	8 20
	9	6 10	6 22	6 35	6 49	6 57	7 07	7 17	7 30	7 36	7 43	7 51	7 59	8 09
	14	6 11	6 21	6 33	6 46	6 53	7 01	7 11	7 22	7 28	7 34	7 40	7 48	7 56
Mar.	19	6 11	6 20	6 30	6 42	6 48	6 55	7 04	7 14	7 19	7 24	7 29	7 36	7 43
	24	6 11	6 19	6 27	6 37	6 43	6 49	6 56	7 05	7 09	7 13	7 18	7 23	7 29
	1	6 10	6 17	6 24	6 32	6 37	6 42	6 48	6 55	6 58	7 02	7 06	7 10	7 15
	6	6 09	6 15	6 20	6 27	6 31	6 35	6 39	6 45	6 48	6 50	6 53	6 57	7 01
	11	6 08	6 12	6 17	6 21	6 24	6 27	6 31	6 35	6 37	6 39	6 41	6 43	6 46
Apr.	16	6 07	6 10	6 13	6 16	6 17	6 19	6 21	6 24	6 25	6 27	6 28	6 29	6 31
	21	6 06	6 07	6 08	6 10	6 11	6 11	6 12	6 13	6 14	6 14	6 15	6 16	6 16
	26	6 04	6 04	6 04	6 04	6 03	6 03	6 03	6 02	6 02	6 02	6 02	6 01	6 01
	31	6 03	6 01	6 00	5 58	5 56	5 55	5 53	5 52	5 51	5 50	5 48	5 47	5 46
	5	6 01	5 58	5 55	5 52	5 49	5 47	5 44	5 41	5 39	5 37	5 35	5 33	5 31
	10	6 00	5 55	5 51	5 46	5 42	5 39	5 35	5 30	5 28	5 25	5 22	5 19	5 16

BEGINNING OF ASTRONOMICAL TWILIGHT

Jan.	0	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
	5	4 44	5 01	5 15	5 30	5 36	5 44	5 51	6 00	6 02	6 06	6 10	6 14	6 18
	10	4 46	5 03	5 18	5 32	5 38	5 45	5 52	6 00	6 03	6 07	6 10	6 14	6 18
	15	4 49	5 05	5 19	5 32	5 39	5 46	5 53	5 59	6 02	6 05	6 09	6 12	6 16
	20	4 51	5 07	5 20	5 33	5 39	5 45	5 51	5 58	6 01	6 03	6 06	6 09	6 12
Feb.	25	4 54	5 08	5 21	5 32	5 38	5 44	5 49	5 55	5 57	5 59	6 02	6 05	6 07
	30	4 55	5 10	5 21	5 32	5 36	5 42	5 46	5 51	5 53	5 55	5 57	5 59	6 01
	4	4 58	5 10	5 21	5 30	5 35	5 39	5 42	5 47	5 48	5 49	5 51	5 52	5 53
	9	4 58	5 10	5 20	5 28	5 32	5 35	5 38	5 41	5 41	5 43	5 44	5 44	5 45
	14	5 00	5 10	5 18	5 25	5 28	5 30	5 32	5 34	5 35	5 35	5 35	5 35	5 35
Mar.	19	5 00	5 10	5 17	5 21	5 24	5 25	5 26	5 27	5 26	5 26	5 26	5 25	5 24
	24	5 01	5 08	5 14	5 18	5 19	5 19	5 20	5 19	5 18	5 16	5 15	5 14	5 12
	1	5 00	5 07	5 11	5 13	5 14	5 13	5 12	5 09	5 07	5 06	5 04	5 02	4 59
	6	5 00	5 05	5 08	5 08	5 08	5 06	5 03	4 59	4 58	4 55	4 52	4 49	4 45
	11	4 59	5 03	5 04	5 04	5 01	4 59	4 54	4 49	4 46	4 43	4 39	4 35	4 29
Apr.	16	4 58	5 00	5 00	4 58	4 55	4 51	4 45	4 38	4 34	4 30	4 25	4 20	4 13
	21	4 57	4 58	4 56	4 51	4 48	4 43	4 36	4 27	4 22	4 17	4 12	4 04	3 56
	26	4 55	4 55	4 52	4 45	4 40	4 34	4 26	4 15	4 09	4 03	3 56	3 48	3 38
	31	4 54	4 52	4 47	4 39	4 33	4 25	4 15	4 03	3 56	3 49	3 40	3 30	3 19
	5	4 52	4 49	4 42	4 32	4 25	4 17	4 05	3 50	3 42	3 34	3 24	3 12	2 58

SOUTHERN LATITUDES (July to October)

For dates on first line below, enter tables above with dates on second line, and apply the correction (in minutes) given on the third line.

Date	July 1	7 12	17 23	28	Aug. 2	Aug. 8	13 18	23 29	Sept. 3	8 13	18 23	28	Oct. 4	Oct. 9
Use	Jan. 0	5 10	15 20	25	Jan. 30	Feb. 4	9 14	19 24	Mar. 1	6 11	16 21	26	Mar. 31	Apr. 5
Apply	+1	0 -2	-3 -4	-6	-7	-8 -9	-10 -11	-12	-13	-14 -14	-14 -15	-15	-15	-15

LOCAL MEAN TIME OF SUNSET AND END OF ASTRONOMICAL
TWILIGHT—MERIDIAN OF GREENWICH

Date \ Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
		SUNSET (UPPER LIMB)												
Jan.	0	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
	5	18 07	17 49	17 31	17 10	16 58	16 44	16 28	16 07	15 58	15 47	15 34	15 20	15 03
	10	18 09	17 52	17 34	17 14	17 02	16 48	16 32	16 13	16 03	15 53	15 41	15 27	15 10
	15	18 11	17 55	17 38	17 18	17 06	16 53	16 38	16 19	16 10	16 00	15 48	15 35	15 20
	20	18 13	17 57	17 41	17 22	17 11	16 59	16 44	16 26	16 17	16 08	15 57	15 45	15 30
Feb.	25	18 15	18 00	17 44	17 26	17 16	17 04	16 50	16 33	16 25	16 16	16 06	15 55	15 42
	30	18 16	18 02	17 47	17 31	17 21	17 10	16 57	16 41	16 34	16 26	16 17	16 06	15 54
	4	18 17	18 04	17 50	17 35	17 26	17 16	17 04	16 50	16 43	16 36	16 27	16 18	16 07
	9	18 17	18 06	17 53	17 39	17 31	17 22	17 11	16 58	16 52	16 46	16 38	16 30	16 20
	14	18 18	18 07	17 56	17 43	17 36	17 28	17 18	17 07	17 02	16 56	16 49	16 42	16 34
Mar.	19	18 18	18 08	17 59	17 47	17 41	17 34	17 26	17 15	17 11	17 06	17 00	16 54	16 47
	24	18 17	18 09	18 01	17 51	17 46	17 40	17 33	17 24	17 20	17 16	17 11	17 06	17 00
	1	18 17	18 10	18 03	17 55	17 51	17 45	17 40	17 33	17 29	17 26	17 22	17 18	17 13
	6	18 16	18 11	18 05	17 59	17 55	17 51	17 46	17 41	17 38	17 36	17 33	17 29	17 26
	11	18 15	18 11	18 07	18 02	17 59	17 56	17 53	17 49	17 47	17 45	17 43	17 41	17 38
Apr.	16	18 13	18 11	18 08	18 05	18 04	18 02	18 00	17 57	17 56	17 55	17 54	17 52	17 51
	21	18 12	18 11	18 10	18 08	18 08	18 07	18 06	18 05	18 05	18 05	18 04	18 04	18 03
	26	18 11	18 11	18 11	18 12	18 12	18 12	18 13	18 13	18 14	18 14	18 14	18 15	18 15
	31	18 09	18 11	18 13	18 15	18 16	18 17	18 19	18 21	18 22	18 23	18 25	18 26	18 27
	5	18 08	18 11	18 14	18 18	18 20	18 23	18 26	18 29	18 31	18 33	18 35	18 37	18 40
		18 06	18 11	18 15	18 21	18 24	18 28	18 32	18 37	18 39	18 42	18 45	18 48	18 52

END OF ASTRONOMICAL TWILIGHT

Jan.	0	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
	0	19 22	19 04	18 50	18 35	18 29	18 21	18 14	18 06	18 03	18 00	17 55	17 52	17 48
	5	19 24	19 07	18 52	18 39	18 32	18 25	18 18	18 11	18 08	18 05	18 01	17 57	17 53
	10	19 25	19 10	18 56	18 43	18 36	18 29	18 23	18 16	18 13	18 10	18 07	18 03	18 00
	15	19 27	19 11	18 58	18 46	18 40	18 35	18 28	18 22	18 19	18 17	18 14	18 11	18 07
	20	19 28	19 14	19 01	18 49	18 44	18 39	18 33	18 28	18 26	18 23	18 21	18 19	18 16
	25	19 29	19 15	19 03	18 54	18 49	18 44	18 39	18 35	18 33	18 31	18 30	18 27	18 25
	30	19 29	19 17	19 06	18 57	18 53	18 49	18 45	18 42	18 41	18 40	18 38	18 37	18 35
Feb.	4	19 29	19 18	19 08	19 01	18 57	18 55	18 52	18 49	18 48	18 48	18 47	18 47	18 45
	9	19 29	19 19	19 11	19 04	19 02	19 00	18 58	18 57	18 57	18 57	18 56	18 57	18 57
	14	19 29	19 19	19 13	19 08	19 06	19 05	19 05	19 04	19 05	19 05	19 06	19 07	19 08
	19	19 27	19 20	19 15	19 11	19 11	19 11	19 11	19 12	19 13	19 15	19 16	19 18	19 20
	24	19 27	19 20	19 17	19 15	19 15	19 15	19 18	19 21	19 22	19 24	19 26	19 29	19 32
Mar.	1	19 25	19 21	19 18	19 19	19 19	19 21	19 24	19 29	19 30	19 34	19 37	19 40	19 45
	6	19 24	19 21	19 20	19 21	19 23	19 26	19 31	19 37	19 40	19 43	19 47	19 53	19 58
	11	19 22	19 21	19 21	19 24	19 28	19 32	19 38	19 45	19 49	19 54	19 59	20 05	20 12
	16	19 21	19 21	19 23	19 28	19 32	19 37	19 44	19 54	19 59	20 05	20 11	20 18	20 26
	21	19 20	19 21	19 24	19 32	19 37	19 43	19 52	20 03	20 09	20 16	20 23	20 32	20 42
	26	19 18	19 21	19 27	19 35	19 41	19 49	19 59	20 13	20 19	20 27	20 37	20 47	20 58
	31	19 17	19 21	19 28	19 39	19 46	19 56	20 08	20 23	20 31	20 40	20 50	21 02	21 17
Apr.	5	19 15	19 21	19 29	19 42	19 51	20 02	20 15	20 33	20 42	20 53	21 05	21 19	21 38

SOUTHERN LATITUDES (July to October)

For dates on first line *below*, enter tables above with dates on second line,
and apply the correction (in minutes) given on the third line.

Date	July	1	7	12	17	23	28	Aug.	2	Aug.	8	13	18	23	29	Sept.	3	8	13	18	23	28	Oct.	4	Oct.	9
Use	Jan.	0	5	10	15	20	25	Jan.	30	Feb.	4	9	14	19	24	Mar.	1	6	11	16	21	26	Mar.	31	Apr.	5
Apply		+1	0	-2	-3	-4	-6		-7		-8	-9	-10	-11	-12		-13	-14	-14	-14	-15	-15		-15		-15

LOCAL MEAN TIME OF SUNRISE AND BEGINNING OF ASTRONOMICAL TWILIGHT—MERIDIAN OF GREENWICH

Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
Date														
SUNRISE (UPPER LIMB)														
Apr.	5	h m 6 00	h m 5 55	h m 5 51	h m 5 46	h m 5 42	h m 5 39	h m 5 35	h m 5 30	h m 5 28	h m 5 25	h m 5 22	h m 5 19	h m 5 16
	10	5 58	5 53	5 47	5 40	5 36	5 31	5 26	5 19	5 16	5 13	5 09	5 05	5 01
	15	5 57	5 50	5 43	5 34	5 29	5 23	5 17	5 09	5 05	5 01	4 56	4 51	4 46
	20	5 56	5 48	5 39	5 29	5 23	5 16	5 08	4 59	4 54	4 49	4 44	4 38	4 31
	25	5 55	5 45	5 35	5 24	5 17	5 09	5 00	4 49	4 44	4 38	4 32	4 25	4 17
May	30	5 54	5 43	5 32	5 19	5 11	5 02	4 52	4 40	4 34	4 27	4 20	4 12	4 03
	5	5 53	5 42	5 29	5 14	5 06	4 56	4 45	4 31	4 24	4 17	4 09	4 00	3 49
	10	5 53	5 40	5 26	5 10	5 01	4 51	4 38	4 23	4 15	4 07	3 58	3 48	3 36
	15	5 53	5 39	5 24	5 07	4 57	4 46	4 32	4 15	4 07	3 58	3 49	3 37	3 24
	20	5 53	5 38	5 22	5 04	4 53	4 41	4 26	4 08	4 00	3 50	3 40	3 27	3 13
June	25	5 53	5 38	5 21	5 02	4 50	4 37	4 22	4 03	3 54	3 43	3 32	3 18	3 02
	30	5 54	5 38	5 20	5 00	4 48	4 34	4 18	3 58	3 48	3 37	3 25	3 11	2 53
	4	5 54	5 38	5 20	4 59	4 47	4 32	4 15	3 54	3 44	3 33	3 20	3 04	2 46
	9	5 55	5 38	5 20	4 58	4 46	4 31	4 13	3 52	3 41	3 29	3 16	3 00	2 40
	14	5 56	5 39	5 20	4 58	4 45	4 30	4 13	3 50	3 40	3 27	3 13	2 57	2 37
July	19	5 57	5 40	5 21	4 59	4 46	4 31	4 13	3 50	3 39	3 27	3 13	2 56	2 35
	24	5 59	5 41	5 22	5 00	4 47	4 32	4 14	3 51	3 40	3 28	3 14	2 57	2 36
	29	6 00	5 42	5 23	5 01	4 48	4 33	4 15	3 53	3 42	3 30	3 16	3 00	2 39
	4	6 01	5 43	5 25	5 03	4 50	4 36	4 18	3 56	3 46	3 34	3 20	3 04	2 44
	9	6 01	5 45	5 27	5 06	4 53	4 39	4 22	4 00	3 50	3 39	3 26	3 10	2 51

BEGINNING OF ASTRONOMICAL TWILIGHT

Apr.	5	h m 4 51	h m 4 46	h m 4 38	h m 4 26	h m 4 17	h m 4 07	h m 3 54	h m 3 36	h m 3 28	h m 3 17	h m 3 06	h m 2 52	h m 2 35
	10	4 49	4 42	4 33	4 19	4 09	3 58	3 43	3 22	3 12	3 01	2 47	2 30	2 09
	15	4 47	4 40	4 28	4 12	4 01	3 48	3 32	3 09	2 57	2 43	2 27	2 06	1 38
	20	4 46	4 36	4 24	4 06	3 54	3 40	3 20	2 55	2 41	2 25	2 05	1 39	0 55
	25	4 44	4 34	4 19	4 00	3 46	3 30	3 09	2 40	2 24	2 05	1 40	1 01	
May	30	4 43	4 31	4 15	3 54	3 39	3 21	2 58	2 24	2 07	1 43	1 08		
	5	4 42	4 29	4 12	3 47	3 32	3 12	2 46	2 09	1 47	1 17	0 07		
	10	4 41	4 26	4 08	3 42	3 25	3 05	2 35	1 52	1 26	0 41			
	15	4 40	4 24	4 05	3 38	3 20	2 56	2 25	1 36	1 01				
	20	4 40	4 23	4 02	3 33	3 14	2 49	2 15	1 18	0 22				
June	25	4 39	4 22	3 59	3 29	3 09	2 43	2 06	0 57	When no times are given, twilight lasts all night.				
	30	4 40	4 21	3 58	3 26	3 06	2 37	1 58	0 31					
	4	4 40	4 21	3 57	3 24	3 02	2 33	1 51						
	9	4 40	4 21	3 56	3 22	3 00	2 30	1 45						
	14	4 41	4 22	3 56	3 22	2 58	2 27	1 41						
July	19	4 42	4 22	3 57	3 22	2 59	2 28	1 40						
	24	4 43	4 22	3 57	3 23	2 59	2 28	1 40						
	29	4 44	4 24	3 59	3 25	3 01	2 30	1 43						
	4	4 45	4 26	4 00	3 27	3 04	2 33	1 48						
	9	4 46	4 27	4 03	3 30	3 08	2 38	1 55						

SOUTHERN LATITUDES (October to January)

For dates on first line *below*, enter tables above with dates on second line, and apply the correction (in minutes) given on the third line.

Date	Oct.	9	13	18	23	28	Nov.	2	Nov.	7	12	17	21	26	Dec.	1	Dec.	6	10	15	20	24	29	Jan.	2	Jan.	7
Use	Apr.	5	10	15	20	25	Apr.	30	May	5	10	15	20	25	May	30	June	4	9	14	19	24	29	July	4	July	9
Apply		-15	-15	-15	-15	-14		-14		-13	-12	-11	-11	-10		-9		-7	-7	-5	-4	-3	-2		-1		+1

LOCAL MEAN TIME OF SUNSET AND END OF ASTRONOMICAL
TWILIGHT—MERIDIAN OF GREENWICH

Date \ Lat.		SUNSET (UPPER LIMB)												
		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
Apr.	5	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
	10	18 06	18 11	18 15	18 21	18 24	18 28	18 32	18 37	18 39	18 42	18 45	18 48	18 52
	15	18 05	18 11	18 17	18 24	18 28	18 33	18 38	18 45	18 48	18 51	18 55	18 59	19 04
	20	18 04	18 10	18 18	18 27	18 32	18 38	18 44	18 53	18 56	19 01	19 05	19 10	19 16
	25	18 02	18 11	18 20	18 30	18 36	18 43	18 51	19 01	19 05	19 10	19 16	19 22	19 29
May	30	18 01	18 11	18 21	18 33	18 40	18 48	18 57	19 08	19 13	19 19	19 26	19 33	19 41
	5	18 00	18 12	18 23	18 36	18 44	18 53	19 03	19 16	19 22	19 29	19 36	19 44	19 54
	10	18 00	18 13	18 25	18 39	18 48	18 58	19 10	19 24	19 30	19 38	19 46	19 55	20 06
	15	18 00	18 14	18 29	18 46	18 56	19 08	19 21	19 38	19 46	19 55	20 05	20 17	20 30
	20	18 00	18 15	18 31	18 49	19 00	19 12	19 27	19 45	19 54	20 03	20 14	20 27	20 42
June	25	18 00	18 16	18 33	18 52	19 04	19 17	19 32	19 52	20 01	20 11	20 23	20 37	20 53
	30	18 01	18 17	18 35	18 55	19 07	19 21	19 37	19 57	20 07	20 18	20 31	20 45	21 03
	4	18 02	18 19	18 37	18 58	19 10	19 24	19 41	20 03	20 13	20 24	20 37	20 53	21 11
	9	18 03	18 20	18 38	19 00	19 13	19 27	19 45	20 07	20 17	20 29	20 43	20 59	21 19
	14	18 04	18 21	18 40	19 02	19 15	19 30	19 48	20 10	20 21	20 33	20 47	21 04	21 24
July	19	18 05	18 22	18 41	19 03	19 16	19 32	19 50	20 12	20 23	20 35	20 50	21 06	21 27
	24	18 06	18 23	18 42	19 05	19 18	19 33	19 51	20 13	20 24	20 36	20 51	21 07	21 28
	29	18 07	18 24	18 43	19 05	19 18	19 33	19 51	20 13	20 24	20 36	20 50	21 07	21 27
	4	18 08	18 25	18 44	19 05	19 18	19 32	19 50	20 12	20 22	20 34	20 48	21 04	21 23
	9	18 09	18 25	18 43	19 04	19 17	19 31	19 48	20 09	20 19	20 31	20 44	20 59	21 17

END OF ASTRONOMICAL TWILIGHT

Apr.	5	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
	10	19 15	19 21	19 29	19 42	19 51	20 02	20 15	20 33	20 42	20 53	21 05	21 19	21 38
	15	19 14	19 22	19 32	19 46	19 56	20 08	20 23	20 44	20 55	21 06	21 21	21 38	22 01
	20	19 14	19 21	19 33	19 50	20 01	20 15	20 31	20 56	21 07	21 22	21 39	22 00	22 31
	25	19 12	19 23	19 36	19 54	20 06	20 22	20 41	21 08	21 22	21 38	22 00	22 28	23 19
May	30	19 12	19 23	19 38	19 58	20 12	20 29	20 50	21 20	21 36	21 56	22 23	23 07	
	5	19 12	19 24	19 41	20 03	20 18	20 36	21 00	21 34	21 53	22 18	22 55		
	10	19 12	19 26	19 44	20 07	20 23	20 43	21 10	21 49	22 11	22 44			
	15	19 12	19 27	19 46	20 12	20 29	20 51	21 20	22 04	22 32	23 23			
	20	19 13	19 29	19 49	20 17	20 35	20 59	21 30	22 21	22 58				
June	25	19 13	19 30	19 52	20 21	20 40	21 05	21 40	22 40	23 53				
	30	19 14	19 32	19 55	20 25	20 46	21 13	21 50	23 02					
	4	19 15	19 34	19 58	20 29	20 51	21 19	21 59	23 32					
	9	19 17	19 36	20 00	20 33	20 55	21 24	22 07						
	14	19 18	19 37	20 02	20 36	20 59	21 29	22 15						
July	19	19 19	19 39	20 04	20 38	21 02	21 33	22 20						
	24	19 20	19 40	20 05	20 40	21 03	21 35	22 23						
	29	19 21	19 41	20 06	20 42	21 05	21 36	22 24						
	4	19 22	19 42	20 07	20 41	21 05	21 36	22 23						
	9	19 23	19 42	20 08	20 41	21 04	21 33	22 19						

When no times are given,
twilight lasts all night.

SOUTHERN LATITUDES (October to January)

For dates on first line *below*, enter tables above with dates on second line,
and apply the correction (in minutes) given on the third line.

Date	Oct.	9	13	18	23	28	Nov.	2	Nov.	7	12	17	21	26	Dec.	1	Dec.	6	10	15	20	24	29	Jan.	2	Jan.	7
Use	Apr.	5	10	15	20	25	Apr.	30	May	5	10	15	20	25	May	30	June	4	9	14	19	24	29	July	4	July	9
Apply		-15	-15	-15	-15	-14		-14		-13	-12	-11	-11	-10		-9		-7	-7	-5	-4	-3	-2		-1		+1

LOCAL MEAN TIME OF SUNRISE AND BEGINNING OF ASTRONOMICAL TWILIGHT—MERIDIAN OF GREENWICH

Date \ Lat.		0° +10° +20° +30° +35° +40° +45° +50° +52° +54° +56° +58° +60°													
		SUNRISE (UPPER LIMB)													
July	4	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	
		6 01	5 43	5 25	5 03	4 50	4 36	4 18	3 56	3 46	3 34	3 20	3 04	2 44	
	9	6 01	5 45	5 27	5 06	4 53	4 39	4 22	4 00	3 50	3 39	3 26	3 10	2 51	
	14	6 02	5 46	5 28	5 08	4 56	4 42	4 26	4 05	3 56	3 45	3 32	3 18	3 00	
	19	6 03	5 47	5 30	5 11	4 59	4 46	4 30	4 11	4 02	3 51	3 40	3 26	3 10	
	24	6 03	5 48	5 32	5 14	5 03	4 50	4 36	4 17	4 09	3 59	3 48	3 35	3 20	
Aug.	29	6 03	5 49	5 34	5 17	5 06	4 55	4 41	4 24	4 16	4 07	3 57	3 45	3 32	
	3	6 03	5 50	5 36	5 20	5 10	4 59	4 46	4 31	4 23	4 15	4 06	3 55	3 43	
	8	6 02	5 50	5 37	5 23	5 14	5 04	4 52	4 38	4 31	4 24	4 16	4 06	3 55	
	13	6 02	5 51	5 39	5 26	5 18	5 09	4 58	4 45	4 39	4 33	4 25	4 17	4 07	
	18	6 01	5 51	5 41	5 29	5 22	5 14	5 04	4 53	4 48	4 42	4 35	4 28	4 19	
Sept.	23	5 59	5 51	5 42	5 31	5 25	5 18	5 10	5 00	4 56	4 51	4 45	4 39	4 31	
	28	5 58	5 51	5 43	5 34	5 29	5 23	5 16	5 08	5 04	5 00	4 55	4 49	4 43	
	2	5 57	5 51	5 44	5 37	5 33	5 28	5 22	5 15	5 12	5 09	5 05	5 00	4 55	
	7	5 55	5 50	5 45	5 40	5 36	5 33	5 28	5 23	5 20	5 17	5 14	5 11	5 07	
	12	5 53	5 50	5 47	5 42	5 40	5 37	5 34	5 30	5 28	5 26	5 24	5 22	5 19	
Oct.	17	5 52	5 50	5 48	5 45	5 44	5 42	5 40	5 38	5 36	5 35	5 34	5 32	5 31	
	22	5 50	5 49	5 49	5 48	5 47	5 47	5 46	5 45	5 45	5 44	5 44	5 43	5 42	
	27	5 48	5 49	5 50	5 51	5 51	5 52	5 52	5 53	5 53	5 53	5 53	5 54	5 54	
	2	5 46	5 49	5 51	5 53	5 55	5 56	5 58	6 00	6 01	6 02	6 03	6 05	6 06	
	7	5 45	5 48	5 52	5 56	5 59	6 01	6 04	6 08	6 10	6 11	6 13	6 16	6 18	

BEGINNING OF ASTRONOMICAL TWILIGHT

July	4	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
		4 45	4 26	4 00	3 27	3 04	2 33	1 48						
	9	4 46	4 27	4 03	3 30	3 08	2 38	1 55						
	14	4 48	4 29	4 05	3 33	3 11	2 44	2 03	0 27	When no times are given, twilight lasts all night.				
	19	4 48	4 31	4 08	3 37	3 17	2 49	2 11	0 59					
Aug.	24	4 50	4 32	4 11	3 41	3 21	2 56	2 21	1 20					
	29	4 50	4 34	4 14	3 45	3 27	3 03	2 31	1 39	1 00				
	3	4 51	4 36	4 15	3 50	3 32	3 10	2 40	1 55	1 27	0 33			
	8	4 50	4 36	4 18	3 54	3 38	3 17	2 50	2 11	1 48	1 14			
	13	4 51	4 38	4 21	3 58	3 43	3 25	3 00	2 25	2 06	1 41	1 01		
Sept.	18	4 50	4 39	4 23	4 02	3 49	3 32	3 09	2 38	2 22	2 02	1 34	0 47	
	23	4 50	4 39	4 26	4 07	3 54	3 38	3 18	2 51	2 37	2 20	1 58	1 28	0 29
	28	4 48	4 40	4 28	4 11	3 59	3 45	3 27	3 03	2 50	2 36	2 18	1 55	1 23
	2	4 48	4 40	4 29	4 14	4 04	3 52	3 35	3 14	3 03	2 51	2 36	2 17	1 54
	7	4 46	4 41	4 31	4 17	4 09	3 58	3 44	3 24	3 16	3 05	2 51	2 37	2 18
Oct.	12	4 45	4 40	4 32	4 21	4 13	4 03	3 51	3 35	3 27	3 17	3 06	2 53	2 38
	17	4 43	4 40	4 33	4 25	4 18	4 09	3 59	3 44	3 37	3 29	3 20	3 09	2 56
	22	4 41	4 39	4 35	4 27	4 22	4 15	4 06	3 54	3 47	3 40	3 33	3 24	3 13
	27	4 39	4 39	4 37	4 30	4 26	4 21	4 13	4 02	3 57	3 51	3 45	3 38	3 28
	2	4 38	4 39	4 38	4 34	4 30	4 25	4 19	4 11	4 07	4 01	3 56	3 49	3 43
	7	4 36	4 38	4 39	4 37	4 34	4 30	4 26	4 19	4 16	4 12	4 07	4 02	3 56

SOUTHERN LATITUDES (January to April)

For dates on first line below, enter tables above with dates on second line, and apply the correction (in minutes) given on the third line.

Date	Jan.	2	7	12	16	21	26	Jan.	31	Feb.	4	9	14	19	23	Feb.	28	Mar.	5	10	15	20	25	Mar.	29	Apr.	3
Use	July	4	9	14	19	24	29	Aug.	3	Aug.	8	13	18	23	28	Sept.	2	Sept.	7	12	17	22	27	Oct.	2	Oct.	7
Apply		-1	+1	+2	+3	+5	+6		+7		+8	+9	+10	+11	+12		+13		+13	+14	+14	+15	+15		+15		+15

LOCAL MEAN TIME OF SUNSET AND END OF ASTRONOMICAL TWILIGHT—MERIDIAN OF GREENWICH

Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
Date														
SUNSET (UPPER LIMB)														
July	4	h m 18 08	h m 18 25	h m 18 44	h m 19 05	h m 19 18	h m 19 32	h m 19 50	h m 20 12	h m 20 22	h m 20 34	h m 20 48	h m 21 04	h m 21 23
	9	18 09	18 25	18 43	19 04	19 17	19 31	19 48	20 09	20 19	20 31	20 44	20 59	21 17
	14	18 09	18 26	18 43	19 03	19 15	19 29	19 45	20 05	20 15	20 26	20 38	20 53	21 10
	19	18 10	18 25	18 42	19 01	19 13	19 26	19 41	20 01	20 10	20 20	20 32	20 45	21 01
	24	18 10	18 25	18 41	18 59	19 10	19 22	19 37	19 55	20 03	20 13	20 24	20 36	20 51
Aug.	29	18 10	18 24	18 39	18 56	19 06	19 18	19 31	19 48	19 56	20 05	20 15	20 26	20 39
	3	18 10	18 23	18 36	18 52	19 02	19 12	19 25	19 41	19 48	19 56	20 05	20 15	20 27
	8	18 09	18 21	18 34	18 48	18 57	19 07	19 18	19 32	19 39	19 46	19 54	20 04	20 17
	13	18 08	18 19	18 31	18 44	18 52	19 00	19 11	19 23	19 29	19 36	19 43	19 51	20 01
	18	18 07	18 17	18 27	18 39	18 46	18 54	19 03	19 14	19 19	19 25	19 31	19 39	19 47
Sept.	23	18 06	18 14	18 23	18 34	18 40	18 46	18 55	19 04	19 09	19 14	19 19	19 25	19 32
	28	18 05	18 12	18 19	18 28	18 33	18 39	18 46	18 54	18 58	19 02	19 07	19 12	19 18
	2	18 03	18 09	18 15	18 22	18 26	18 31	18 37	18 44	18 47	18 50	18 54	18 58	19 03
	7	18 02	18 06	18 11	18 16	18 20	18 23	18 28	18 33	18 35	18 38	18 41	18 44	18 48
	12	18 00	18 03	18 06	18 10	18 12	18 15	18 18	18 22	18 24	18 26	18 28	18 30	18 33
Oct.	17	17 58	18 00	18 02	18 04	18 05	18 07	18 09	18 11	18 12	18 13	18 14	18 16	18 17
	22	17 56	17 57	17 57	17 58	17 58	17 59	17 59	18 00	18 00	18 01	18 01	18 02	18 02
	27	17 54	17 53	17 52	17 51	17 51	17 50	17 50	17 49	17 49	17 48	17 48	17 47	17 47
	2	17 53	17 50	17 48	17 45	17 44	17 42	17 40	17 38	17 37	17 36	17 35	17 33	17 32
	7	17 51	17 48	17 44	17 39	17 37	17 34	17 31	17 27	17 26	17 24	17 22	17 19	17 17

END OF ASTRONOMICAL TWILIGHT

		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m		
July	4	19	23	19	42	20	08	20	41	21	04	21	33	22	19						
	9	19	24	19	42	20	06	20	39	21	02	21	31	22	14						
	14	19	23	19	43	20	06	20	37	20	58	21	27	22	06						
	19	19	24	19	41	20	04	20	34	20	55	21	21	21	58	23	09	When no times are given,			
	24	19	23	19	41	20	02	20	31	20	50	21	15	21	50	22	48	23	45	twilight lasts all night.	
Aug.	29	19	23	19	39	19	59	20	26	20	44	21	08	21	39	22	30	23	05		
	3	19	22	19	37	19	55	20	21	20	39	21	00	21	29	22	13	22	40	23	27
	8	19	21	19	35	19	53	20	16	20	32	20	52	21	18	21	56	22	19	22	50
	13	19	19	19	32	19	49	20	10	20	25	20	43	21	07	21	40	21	59	22	24
	18	19	18	19	29	19	44	20	04	20	18	20	35	20	56	21	26	21	41	22	01
Sept.	23	19	16	19	26	19	39	19	58	20	10	20	25	20	45	21	11	21	25	21	41
	28	19	15	19	23	19	34	19	51	20	02	20	16	20	33	20	57	21	09	21	23
	2	19	12	19	20	19	30	19	44	19	54	20	06	20	22	20	43	20	53	21	05
	7	19	11	19	16	19	25	19	37	19	47	19	57	20	11	20	29	20	38	20	48
	12	19	09	19	13	19	20	19	31	19	38	19	48	19	59	20	15	20	24	20	33
Oct.	17	19	07	19	10	19	15	19	24	19	30	19	39	19	49	20	02	20	09	20	17
	22	19	05	19	07	19	10	19	18	19	23	19	30	19	38	19	50	19	55	20	02
	27	19	03	19	03	19	05	19	11	19	15	19	20	19	28	19	38	19	43	19	48
	2	19	02	19	00	19	01	19	04	19	08	19	12	19	18	19	26	19	30	19	35
	7	19	00	18	58	18	57	18	58	19	01	19	04	19	08	19	14	19	18	19	22

SOUTHERN LATITUDES (January to April)

For dates on first line *below*, enter tables above with dates on second line, and apply the correction (in minutes) given on the third line.

Date	Jan.	2	7	12	16	21	26	Jan.	31	Feb.	4	9	14	19	23	Feb.	28	Mar.	5	10	15	20	25	Mar.	29	Apr.	3
Use	July	4	9	14	19	24	29	Aug.	3	Aug.	8	13	18	23	28	Sept.	2	Sept.	7	12	17	22	27	Oct.	2	Oct.	7
Apply		-1	+1	+2	+3	+5	+6		+7		+8	+9	+10	+11	+12		+13		+13	+14	+14	+15	+15		+15	+15	

LOCAL MEAN TIME OF SUNRISE AND BEGINNING OF ASTRONOMICAL TWILIGHT—MERIDIAN OF GREENWICH

Date \ Lat.		Sunrise (Upper Limb)												
		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
Oct.	2	5 46	5 49	5 51	5 53	5 55	5 56	5 58	6 00	6 01	6 02	6 03	6 05	6 06
	7	5 45	5 48	5 52	5 56	5 59	6 01	6 04	6 08	6 10	6 11	6 13	6 16	6 18
	12	5 43	5 48	5 54	5 59	6 03	6 06	6 11	6 16	6 18	6 21	6 23	6 27	6 30
	17	5 42	5 49	5 55	6 03	6 07	6 12	6 17	6 24	6 27	6 30	6 34	6 38	6 42
	22	5 41	5 49	5 57	6 06	6 11	6 17	6 24	6 32	6 36	6 40	6 44	6 49	6 55
Nov.	27	5 41	5 49	5 59	6 10	6 16	6 23	6 31	6 40	6 45	6 49	6 55	7 01	7 07
	1	5 40	5 50	6 01	6 13	6 20	6 28	6 37	6 48	6 54	6 59	7 05	7 12	7 20
	6	5 40	5 52	6 04	6 17	6 25	6 34	6 44	6 57	7 03	7 09	7 16	7 24	7 33
	11	5 40	5 53	6 06	6 21	6 30	6 40	6 51	7 05	7 12	7 19	7 27	7 36	7 46
	16	5 41	5 55	6 09	6 25	6 35	6 45	6 58	7 13	7 20	7 28	7 37	7 47	7 59
Dec.	21	5 42	5 57	6 12	6 29	6 40	6 51	7 05	7 21	7 29	7 38	7 47	7 58	8 11
	26	5 43	5 59	6 15	6 34	6 44	6 57	7 11	7 29	7 37	7 46	7 57	8 09	8 23
	1	5 45	6 01	6 18	6 38	6 49	7 02	7 17	7 36	7 45	7 55	8 06	8 19	8 34
	6	5 47	6 04	6 21	6 42	6 53	7 07	7 23	7 42	7 51	8 02	8 14	8 27	8 43
	11	5 49	6 06	6 24	6 45	6 57	7 11	7 27	7 48	7 57	8 08	8 20	8 35	8 51
	16	5 52	6 09	6 27	6 49	7 01	7 15	7 32	7 52	8 02	8 13	8 26	8 40	8 58
	21	5 54	6 11	6 30	6 51	7 04	7 18	7 35	7 55	8 05	8 17	8 29	8 44	9 02
	26	5 57	6 14	6 32	6 54	7 06	7 20	7 37	7 58	8 08	8 19	8 31	8 46	9 04
	31	5 59	6 16	6 35	6 55	7 08	7 22	7 38	7 59	8 08	8 19	8 32	8 46	9 03
	36	6 01	6 18	6 36	6 57	7 09	7 22	7 38	7 58	8 08	8 18	8 30	8 44	9 01

BEGINNING OF ASTRONOMICAL TWILIGHT

Oct.	2	h m 4 38	h m 4 39	h m 4 38	h m 4 34	h m 4 30	h m 4 25	h m 4 19	h m 4 11	h m 4 07	h m 4 01	h m 3 56	h m 3 49	h m 3 43
	7	4 36	4 38	4 39	4 37	4 34	4 30	4 26	4 19	4 16	4 12	4 07	4 02	3 56
	12	4 35	4 38	4 40	4 40	4 38	4 35	4 32	4 27	4 24	4 21	4 17	4 13	4 09
	17	4 32	4 39	4 41	4 42	4 42	4 41	4 38	4 35	4 33	4 30	4 28	4 25	4 21
	22	4 31	4 38	4 43	4 45	4 46	4 46	4 44	4 42	4 41	4 40	4 38	4 36	4 33
Nov.	27	4 31	4 38	4 45	4 49	4 50	4 50	4 51	4 50	4 50	4 48	4 48	4 46	4 45
	1	4 29	4 39	4 46	4 52	4 54	4 56	4 57	4 58	4 58	4 57	4 57	4 56	4 56
	6	4 29	4 39	4 48	4 55	4 58	5 01	5 03	5 05	5 06	5 06	5 06	5 07	5 07
	11	4 28	4 40	4 50	4 58	5 02	5 05	5 09	5 12	5 13	5 14	5 16	5 16	5 16
	16	4 28	4 41	4 52	5 01	5 07	5 10	5 15	5 19	5 21	5 22	5 24	5 25	5 27
Dec.	21	4 29	4 42	4 54	5 06	5 11	5 16	5 20	5 26	5 27	5 30	5 31	5 34	5 37
	26	4 29	4 44	4 57	5 09	5 14	5 21	5 26	5 32	5 34	5 37	5 39	5 42	5 44
	1	4 31	4 47	5 00	5 13	5 19	5 25	5 31	5 37	5 40	5 43	5 46	5 50	5 53
	6	4 33	4 48	5 03	5 16	5 22	5 29	5 36	5 43	5 46	5 49	5 53	5 57	6 00
	11	4 34	4 51	5 06	5 20	5 27	5 33	5 41	5 48	5 51	5 55	5 58	6 02	6 06
	16	4 36	4 53	5 08	5 23	5 29	5 37	5 44	5 52	5 55	5 59	6 03	6 07	6 11
	21	4 39	4 56	5 11	5 25	5 32	5 39	5 47	5 55	5 59	6 02	6 07	6 10	6 15
	26	4 41	4 59	5 13	5 27	5 35	5 42	5 50	5 57	6 01	6 04	6 09	6 13	6 17
	31	4 44	5 01	5 15	5 30	5 36	5 43	5 51	6 00	6 02	6 06	6 10	6 14	6 18
	36	4 46	5 03	5 18	5 31	5 38	5 45	5 52	6 00	6 03	6 07	6 10	6 14	6 18

SOUTHERN LATITUDES (April to July)

For dates on first line *below*, enter tables above with dates on second line, and apply the correction (in minutes) given on the third line.

Date	Apr.	3	9	14	19	24	Apr.	29	May	4	9	14	20	25	May	30	June	4	10	15	21	26	July	1	7
Use	Oct.	7	12	17	22	27	Nov.	1	Nov.	6	11	16	21	26	Dec.	1	Dec.	6	11	16	21	26	Dec.	31	36
Apply		+15	+15	+15	+15	+14		+14		+13	+13	+12	+11	+10		+9		+7	+6	+5	+4	+2		+1	0

LOCAL MEAN TIME OF SUNSET AND END OF ASTRONOMICAL
TWILIGHT—MERIDIAN OF GREENWICH

Date		Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
		SUNSET (UPPER LIMB)													
Oct.	2	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
	7	17 53	17 50	17 48	17 45	17 44	17 42	17 40	17 38	17 37	17 36	17 35	17 33	17 32	17 32
	12	17 51	17 48	17 44	17 39	17 37	17 34	17 31	17 27	17 26	17 24	17 22	17 19	17 17	17 17
	17	17 50	17 45	17 39	17 33	17 30	17 26	17 22	17 17	17 14	17 12	17 09	17 06	17 02	17 02
	22	17 49	17 42	17 36	17 28	17 24	17 19	17 13	17 06	17 03	17 00	16 56	16 52	16 48	16 48
Nov.	27	17 48	17 40	17 32	17 23	17 18	17 12	17 05	16 57	16 53	16 49	16 44	16 39	16 33	16 33
	1	17 47	17 38	17 29	17 18	17 12	17 05	16 57	16 47	16 43	16 38	16 32	16 26	16 19	16 19
	6	17 47	17 37	17 26	17 14	17 07	16 59	16 49	16 38	16 33	16 27	16 21	16 14	16 06	16 06
	11	17 47	17 36	17 24	17 10	17 02	16 53	16 43	16 30	16 24	16 18	16 10	16 02	15 53	15 53
	16	17 48	17 35	17 22	17 07	16 58	16 48	16 36	16 22	16 16	16 09	16 01	15 52	15 41	15 41
Dec.	21	17 48	17 35	17 20	17 04	16 54	16 44	16 31	16 16	16 08	16 00	15 52	15 42	15 30	15 30
	26	17 49	17 35	17 19	17 02	16 52	16 40	16 26	16 10	16 02	15 53	15 44	15 33	15 20	15 20
	1	17 51	17 35	17 19	17 01	16 50	16 37	16 23	16 05	15 57	15 48	15 37	15 25	15 11	15 11
	6	17 53	17 36	17 19	17 00	16 49	16 36	16 20	16 02	15 53	15 43	15 32	15 19	15 04	15 04
	11	17 55	17 38	17 20	17 00	16 48	16 35	16 19	15 59	15 50	15 40	15 28	15 14	14 58	14 58
	16	17 57	17 40	17 22	17 01	16 49	16 35	16 18	15 58	15 49	15 38	15 26	15 11	14 54	14 54
	21	17 59	17 42	17 23	17 02	16 50	16 36	16 19	15 58	15 49	15 38	15 25	15 10	14 53	14 53
	26	18 01	17 44	17 25	17 04	16 52	16 38	16 21	16 00	15 50	15 39	15 26	15 11	14 54	14 54
	31	18 04	17 47	17 28	17 07	16 55	16 40	16 24	16 03	15 53	15 42	15 29	15 15	14 57	14 57
	36	18 07	17 49	17 31	17 10	16 58	16 44	16 27	16 07	15 57	15 46	15 34	15 20	15 03	15 03
	36	18 09	17 52	17 34	17 14	17 02	16 48	16 32	16 12	16 03	15 52	15 40	15 26	15 10	15 10

END OF ASTRONOMICAL TWILIGHT

Oct.	2	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
	7	19 02	19 00	19 01	19 04	19 08	19 12	19 18	19 26	19 30	19 35	19 40	19 45	19 53
	12	19 00	18 58	18 57	18 58	19 01	19 04	19 08	19 14	19 18	19 22	19 26	19 30	19 36
	17	18 59	18 55	18 52	18 52	18 54	18 56	18 59	19 04	19 06	19 10	19 13	19 17	19 21
	22	18 59	18 52	18 50	18 48	18 48	18 49	18 51	18 53	18 55	18 58	19 00	19 03	19 07
Nov.	27	18 58	18 58	18 46	18 43	18 42	18 42	18 43	18 45	18 46	18 47	18 48	18 50	18 52
	1	18 57	18 49	18 43	18 38	18 37	18 36	18 36	18 36	18 36	18 37	18 37	18 38	18 40
	6	18 58	18 49	18 41	18 35	18 33	18 31	18 28	18 27	18 27	18 27	18 28	18 28	18 28
	11	18 58	18 48	18 39	18 31	18 28	18 25	18 23	18 20	18 20	18 19	18 18	18 18	18 17
	16	19 00	18 48	18 38	18 29	18 25	18 21	18 17	18 14	18 13	18 12	18 11	18 10	18 08
Dec.	21	19 01	18 48	18 36	18 27	18 21	18 18	18 13	18 09	18 06	18 05	18 04	18 02	18 00
	26	19 02	18 49	18 36	18 25	18 20	18 15	18 09	18 04	18 02	17 59	17 58	17 56	17 53
	1	19 05	18 49	18 36	18 25	18 19	18 12	18 07	18 01	17 58	17 56	17 53	17 50	17 47
	6	19 07	18 51	18 37	18 24	18 18	18 12	18 05	17 59	17 56	17 53	17 50	17 47	17 43
	11	19 10	18 53	18 38	18 25	18 18	18 12	18 05	17 57	17 54	17 51	17 48	17 44	17 40
	16	19 12	18 55	18 40	18 26	18 19	18 12	18 04	17 57	17 54	17 50	17 47	17 42	17 38
	21	19 14	18 57	18 42	18 27	18 21	18 14	18 06	17 57	17 55	17 51	17 47	17 43	17 39
	26	19 16	18 59	18 44	18 30	18 23	18 16	18 08	18 00	17 56	17 53	17 48	17 44	17 40
	31	19 19	19 02	18 47	18 32	18 26	18 18	18 11	18 02	17 59	17 55	17 51	17 48	17 43
	36	19 22	19 04	18 50	18 35	18 29	18 21	18 13	18 06	18 02	17 59	17 56	17 52	17 48
	36	19 24	19 07	18 52	18 39	18 32	18 25	18 18	18 10	18 08	18 04	18 00	17 56	17 53

SOUTHERN LATITUDES (April to July)

For dates on first line below, enter tables above with dates on second line,
and apply the correction (in minutes) given on the third line.

Date	Apr. 3	9	14	19	24	Apr. 29	May 4	9	14	20	25	May 30	June 4	10	15	21	26	July 1	7
Use	Oct. 7	12	17	22	27	Nov. 1	Nov. 6	11	16	21	26	Dec. 1	Dec. 6	11	16	21	26	Dec. 31	36
Apply	+15	+15	+15	+15	+14	+14	+13	+13	+12	+11	+10	+9	+7	+6	+5	+4	+2	+1	0

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°		+10°		+20°		+30°		+35°		+40°		+45°		+50°		+52°		+54°		+56°		+58°		+60°	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Jan.	0	21	53	21	42	21	31	21	18	21	10	21	01	20	51	20	38	20	32	20	26	20	19	20	10	20	01
	1	22	44	22	38	22	31	22	24	22	20	22	15	22	09	22	02	21	59	21	56	21	52	21	48	21	43
	2	23	32	23	31	23	30	23	29	23	28	23	27	23	26	23	25	23	24	23	24	23	23	23	22	23	21
	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	4	0	20	0	24	0	28	0	33	0	35	0	38	0	42	0	46	0	48	0	51	0	53	0	56	0	59
	5	1	09	1	17	1	27	1	37	1	43	1	50	1	58	2	08	2	13	2	18	2	24	2	30	2	37
	6	1	59	2	12	2	26	2	43	2	52	3	03	3	15	3	31	3	38	3	47	3	56	4	07	4	19
	7	2	52	3	09	3	28	3	49	4	01	4	15	4	32	4	54	5	04	5	15	5	29	5	44	6	03
	8	3	48	4	08	4	30	4	54	5	09	5	26	5	47	6	13	6	25	6	40	6	57	7	17	7	44
	9	4	46	5	07	5	31	5	57	6	13	6	31	6	54	7	23	7	37	7	53	8	12	8	36	9	08
	10	5	43	6	05	6	28	6	55	7	10	7	29	7	51	8	19	8	33	8	49	9	08	9	31	10	01
	11	6	39	6	59	7	20	7	45	7	59	8	16	8	36	9	02	9	14	9	27	9	44	10	03	10	26
	12	7	31	7	48	8	07	8	28	8	40	8	55	9	11	9	32	9	42	9	53	10	06	10	20	10	37
	13	8	19	8	33	8	48	9	05	9	15	9	26	9	39	9	55	10	03	10	11	10	20	10	31	10	43
	14	9	03	9	13	9	24	9	37	9	44	9	52	10	02	10	13	10	18	10	24	10	30	10	37	10	45
	15	9	45	9	51	9	58	10	06	10	10	10	15	10	20	10	27	10	30	10	34	10	38	10	42	10	47
	16	10	24	10	27	10	29	10	32	10	34	10	36	10	38	10	40	10	41	10	43	10	44	10	46	10	47
	17	11	04	11	02	11	00	10	58	10	57	10	56	10	54	10	53	10	52	10	51	10	50	10	49	10	48
	18	11	43	11	38	11	31	11	25	11	21	11	16	11	11	11	05	11	03	11	00	10	56	10	53	10	48
	19	12	25	12	15	12	05	11	53	11	46	11	39	11	30	11	20	11	15	11	09	11	04	10	57	10	50
	20	13	09	12	55	12	41	12	24	12	15	12	04	11	52	11	37	11	30	11	22	11	13	11	03	10	52
	21	13	57	13	40	13	21	13	01	12	49	12	35	12	19	11	59	11	50	11	39	11	27	11	13	10	58
	22	14	49	14	29	14	08	13	44	13	30	13	13	12	54	12	29	12	17	12	04	11	49	11	30	11	08
	23	15	46	15	25	15	02	14	34	14	19	14	01	13	39	13	11	12	58	12	42	12	24	12	02	11	32
	24	16	46	16	25	16	01	15	34	15	19	15	00	14	38	14	09	13	55	13	39	13	20	12	56	12	25
	25	17	47	17	27	17	06	16	41	16	26	16	09	15	49	15	23	15	10	14	56	14	39	14	18	13	53
	26	18	47	18	30	18	12	17	51	17	39	17	25	17	08	16	47	16	37	16	26	16	13	15	58	15	40
	27	19	44	19	31	19	17	19	02	18	53	18	43	18	30	18	16	18	09	18	01	17	52	17	42	17	31
	28	20	37	20	29	20	21	20	11	20	06	20	00	19	53	19	44	19	40	19	35	19	30	19	24	19	18
	29	21	28	21	25	21	22	21	19	21	17	21	15	21	12	21	10	21	08	21	07	21	05	21	03	21	01
Feb.	30	22	17	22	19	22	22	22	25	22	27	22	29	22	31	22	34	22	35	22	36	22	38	22	40	22	42
	31	23	06	23	13	23	21	23	31	23	35	23	41	23	49	23	57	...	...	...	...	...	...	...	...	...	...
	1	23	56	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0	01	0	05	0	10	0	15	0	22
	2	...	...	0	08	0	21	0	36	0	44	0	54	1	06	1	20	1	27	1	34	1	43	1	52	2	03
	3	0	48	1	05	1	22	1	42	1	53	2	07	2	23	2	43	2	52	3	03	3	15	3	29	3	46
	4	1	43	2	02	2	23	2	47	3	01	3	18	3	37	4	02	4	14	4	28	4	45	5	04	5	28
	5	2	39	3	00	3	24	3	50	4	06	4	24	4	46	5	14	5	28	5	44	6	04	6	27	6	59
	6	3	36	3	58	4	21	4	48	5	04	5	23	5	45	6	14	6	28	6	45	7	04	7	29	8	01
	7	4	31	4	52	5	14	5	40	5	55	6	12	6	34	7	00	7	13	7	28	7	45	8	06	8	32
	8	5	24	5	42	6	02	6	25	6	38	6	53	7	11	7	34	7	45	7	57	8	11	8	27	8	46
	9	6	13	6	28	6	45	7	03	7	14	7	26	7	41	7	59	8	07	8	16	8	27	8	39	8	53
	10	6	58	7	10	7	23	7	37	7	45	7	54	8	05	8	18	8	24	8	31	8	38	8	46	8	56
	11	7	41	7	49	7	57	8	06	8	12	8	18	8	25	8	33	8	37	8	41	8	46	8	51	8	57
	12	8	21	8	25	8	29	8	34	8	36	8	39	8	42	8	47	8	48	8	50	8	53	8	55	8	58
	13	9	00	9	00	9	00	9	00	8	59	8	59	8	59	8	59	8	59	8	59	8	58	8	58	8	58
	14	9	40	9	35	9	31	9	26	9	23	9	19	9	15	9	11	9	09	9	07	9	04	9	01	8	58
	15	10	20	10	11	10	03	9	53	9	47	9	41	9	33	9	24	9	20	9	16	9	11	9	05	8	59
	16	11	02	10	50	10	37	10	22	10	14	10	04	9	53	9	40	9	33	9	26	9	19	9	10	9	01

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
		^h ^m	^h ^m	^h ^m	^h ^m	^h ^m	^h ^m	^h ^m	^h ^m	^h ^m	^h ^m	^h ^m	^h ^m	^h ^m
Jan.	0	9 26	9 39	9 52	10 08	10 17	10 27	10 39	10 53	11 00	11 07	11 15	11 24	11 35
	1	10 18	10 26	10 35	10 45	10 50	10 57	11 04	11 13	11 17	11 22	11 27	11 32	11 38
	2	11 07	11 11	11 14	11 18	11 21	11 23	11 26	11 30	11 32	11 34	11 36	11 38	11 40
	3	11 55	11 54	11 52	11 51	11 50	11 49	11 47	11 46	11 45	11 44	11 44	11 43	11 42
	4	12 43	12 37	12 30	12 23	12 19	12 14	12 08	12 02	11 59	11 56	11 52	11 48	11 43
	5	13 32	13 22	13 10	12 57	12 50	12 41	12 31	12 19	12 14	12 08	12 01	11 54	11 45
	6	14 24	14 09	13 53	13 35	13 24	13 12	12 58	12 41	12 33	12 24	12 14	12 03	11 49
	7	15 19	15 00	14 40	14 17	14 05	13 49	13 31	13 09	12 58	12 46	12 32	12 16	11 57
	8	16 16	15 55	15 32	15 06	14 51	14 34	14 12	13 46	13 33	13 18	13 01	12 40	12 13
	9	17 13	16 52	16 28	16 01	15 45	15 26	15 04	14 35	14 21	14 05	13 45	13 21	12 49
	10	18 10	17 49	17 26	17 00	16 45	16 26	16 05	15 37	15 23	15 07	14 49	14 25	13 55
	11	19 04	18 45	18 24	18 01	17 47	17 31	17 11	16 47	16 35	16 22	16 06	15 47	15 24
	12	19 54	19 38	19 21	19 01	18 50	18 36	18 20	18 01	17 51	17 41	17 29	17 15	16 58
	13	20 40	20 28	20 15	20 00	19 51	19 41	19 29	19 14	19 07	18 59	18 51	18 41	18 30
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LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date \ Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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	22	16 28	16 09	15 49	15 25	15 12	14 56	14 37	14 13	14 02	13 49	13 34	13 16	12 54
	23	17 26	17 11	16 56	16 37	16 26	16 14	15 59	15 41	15 33	15 23	15 12	15 00	14 45
	24	18 22	18 12	18 01	17 49	17 41	17 33	17 23	17 12	17 06	17 00	16 53	16 45	16 37
Mar.	25	19 16	19 11	19 05	18 59	18 56	18 52	18 47	18 41	18 39	18 36	18 33	18 29	18 25
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	28	21 50	22 00	22 12	22 25	22 32	22 41	22 51	23 03	23 09	23 16	23 23	23 31	23 40
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	27	19 36	19 44	19 53	20 03	20 09	20 16	20 24	20 33	20 38	20 43	20 48	20 54	21 01
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Apr.	1	0 10	0 38	0 54	1 13	1 36	2 06	2 20	2 37	2 58	3 23	3 59
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LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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	28	9 23	9 15	9 06	8 56	8 51	8 45	8 37	8 29	8 25	8 20	8 16	8 10	8 04
Mar.	1	10 15	10 02	9 49	9 33	9 24	9 14	9 02	8 48	8 42	8 34	8 26	8 17	8 07
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LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date \ Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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	17	0 10	0 25	0 40	0 57	1 07	1 18	1 31	1 47	1 54	2 02	2 12	2 22	2 34
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LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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May	17	12 37	12 25	12 12	11 57	11 49	11 39	11 27	11 13	11 06	10 59	10 50	10 41	10 30
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	24	18 50	19 11	19 33	19 59	20 14	20 32	20 53	21 20	21 34	21 49	22 07	22 30	22 59
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	27	21 51	22 11	22 32	22 57	23 11	23 28	23 48	0 02	0 21	0 45	1 17
	28	22 43	23 00	23 19	23 39	23 51	0 12	0 24	0 38	0 54	1 12	1 36
	29	23 31	23 45	23 59	0 05	0 21	0 41	0 50	1 01	1 13	1 27	1 43
	30	0 15	0 24	0 34	0 47	1 02	1 09	1 16	1 25	1 35	1 46
	31	0 15	0 24	0 34	0 46	0 52	0 59	1 08	1 18	1 23	1 28	1 33	1 40	1 47
June	1	0 56	1 01	1 07	1 13	1 17	1 21	1 26	1 31	1 34	1 37	1 40	1 43	1 47
	2	1 36	1 37	1 38	1 39	1 40	1 41	1 42	1 43	1 44	1 45	1 45	1 46	1 47
	3	2 15	2 12	2 08	2 05	2 03	2 01	1 58	1 55	1 54	1 52	1 50	1 49	1 47
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	30	0 11	0 10	0 08	0 06	0 05	0 04	0 03	0 02	0 01	0 00	0 00	...	23 57
July	1	0 51	0 45	0 39	0 32	0 29	0 24	0 20	0 14	0 11	0 08	0 05	0 01	23 58
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LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date \ Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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May	17	0 10	0 25	0 40	0 57	1 07	1 18	1 31	1 47	1 54	2 02	2 12	2 22	2 34
	18	1 01	1 11	1 22	1 33	1 40	1 47	1 56	2 06	2 11	2 16	2 22	2 29	2 36
	19	1 51	1 56	2 01	2 07	2 10	2 14	2 18	2 23	2 25	2 28	2 30	2 34	2 37
	20	2 40	2 40	2 40	2 39	2 39	2 39	2 39	2 38	2 38	2 38	2 38	2 38	2 38
	21	3 30	3 25	3 19	3 13	3 09	3 05	3 00	2 54	2 52	2 49	2 46	2 42	2 38
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	23	5 19	5 03	4 47	4 29	4 18	4 06	3 52	3 34	3 26	3 17	3 07	2 55	2 42
	24	6 18	5 59	5 38	5 15	5 01	4 46	4 27	4 04	3 52	3 40	3 25	3 09	2 48
	25	7 20	6 58	6 35	6 08	5 52	5 34	5 12	4 44	4 30	4 15	3 56	3 33	3 04
	26	8 22	7 59	7 35	7 07	6 51	6 32	6 08	5 39	5 24	5 07	4 46	4 20	3 44
	27	9 21	9 00	8 37	8 11	7 55	7 37	7 15	6 46	6 32	6 16	5 57	5 34	5 02
	28	10 16	9 58	9 37	9 14	9 01	8 45	8 26	8 02	7 50	7 37	7 21	7 03	6 41
	29	11 07	10 52	10 35	10 16	10 05	9 52	9 37	9 18	9 09	8 59	8 48	8 35	8 19
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	31	12 35	12 28	12 20	12 11	12 06	12 00	11 53	11 44	11 40	11 36	11 31	11 26	11 19
June	1	13 15	13 12	13 08	13 05	13 02	13 00	12 57	12 53	12 51	12 49	12 47	12 45	12 42
	2	13 54	13 55	13 56	13 57	13 58	13 58	13 59	14 00	14 01	14 01	14 02	14 02	14 03
	3	14 33	14 39	14 44	14 50	14 53	14 57	15 02	15 08	15 10	15 13	15 16	15 20	15 24
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July	1	13 10	13 17	13 26	13 35	13 40	13 46	13 53	14 02	14 06	14 10	14 15	14 21	14 27
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LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)

MERIDIAN OF GREENWICH

Date \ Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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	3	2 14	2 01	1 46	1 30	1 21	1 11	0 58	0 43	0 36	0 28	0 20	0 10	...
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	14	11 46	11 51	11 56	12 02	12 05	12 09	12 13	12 19	12 21	12 24	12 27	12 30	12 34
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Aug.	31	0 53	0 37	0 20	0 01	23 52	23 29	23 18	23 06	22 52	22 35	22 16
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LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Lat. Date		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
July	1	^h 13 ^m 10	^h 13 ^m 17	^h 13 ^m 26	^h 13 ^m 35	^h 13 ^m 40	^h 13 ^m 46	^h 13 ^m 53	^h 14 ^m 02	^h 14 ^m 06	^h 14 ^m 10	^h 14 ^m 15	^h 14 ^m 21	^h 14 ^m 27
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Aug.	16	1 00	0 48	0 36	0 21	0 13	0 04	23 53	23 44	23 32	23 20	23 05
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	18	2 51	2 31	2 10	1 46	1 32	1 16	0 56	0 32	0 20	0 07	23 30
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LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date		Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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	18		17 05	17 23	17 42	18 03	18 15	18 30	18 47	19 08	19 18	19 30	19 43	19 57	20 15
	19		17 54	18 08	18 24	18 41	18 50	19 02	19 15	19 31	19 38	19 46	19 56	20 06	20 18
	20		18 40	18 50	19 01	19 13	19 20	19 28	19 37	19 48	19 53	19 59	20 05	20 11	20 19
	21		19 23	19 28	19 35	19 42	19 46	19 50	19 56	20 02	20 05	20 08	20 11	20 15	20 19
	22		20 03	20 05	20 06	20 08	20 09	20 11	20 12	20 14	20 15	20 16	20 17	20 18	20 19
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	24		21 22	21 16	21 09	21 01	20 56	20 51	20 45	20 38	20 35	20 31	20 27	20 23	20 18
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	26		22 46	22 32	22 16	21 59	21 49	21 37	21 24	21 08	21 00	20 52	20 42	20 31	20 19
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	29		1 15	0 53	0 29	0 02	23 46	23 27	23 04	22 36	22 21	22 05	21 46	21 21	20 49
	30		2 11	1 49	1 25	0 57	0 41	0 22	23 59	23 29	23 14	22 57	22 36	22 10	21 35
Sept.	31		3 09	2 48	2 25	1 59	1 44	1 26	1 04	0 37	0 23	0 08	23 49	23 27	22 58
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	27		0 55	0 33	0 10	0 00	0 00	0 00	23 54	23 29	23 16	23 02	22 46	22 26	22 01
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Oct.	29		2 46	2 29	2 12	1 52	1 40	1 27	1 10	0 51	0 41	0 30	0 18	0 04	0 00
	30		3 39	3 27	3 14	3 00	2 51	2 42	2 30	2 16	2 10	2 03	1 55	1 45	1 35
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LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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	21	7 01	6 53	6 44	6 34	6 28	6 22	6 14	6 05	6 01	5 56	5 51	5 45	5 38
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	25	9 42	9 51	10 00	10 11	10 17	10 24	10 32	10 42	10 47	10 52	10 58	11 04	11 11
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Sept.	31	14 39	15 01	15 24	15 51	16 06	16 25	16 47	17 15	17 29	17 45	18 03	18 26	18 56
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LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date		Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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	2		5 43	5 55	6 07	6 22	6 30	6 40	6 51	7 05	7 12	7 19	7 27	7 37	7 48
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	4		7 43	8 03	8 25	8 50	9 05	9 23	9 44	10 11	10 24	10 39	10 57	11 19	11 47
	5		8 46	9 09	9 33	10 01	10 17	10 37	11 01	11 31	11 46	12 04	12 25	12 52	13 30
	6		9 49	10 12	10 36	11 04	11 20	11 40	12 03	12 33	12 48	13 05	13 26	13 52	14 28
	7		10 49	11 10	11 32	11 58	12 13	12 30	12 51	13 17	13 30	13 45	14 02	14 22	14 48
	8		11 43	12 01	12 20	12 42	12 55	13 09	13 26	13 48	13 58	14 09	14 22	14 37	14 55
	9		12 33	12 47	13 02	13 19	13 29	13 40	13 53	14 09	14 17	14 25	14 34	14 45	14 57
	10		13 18	13 28	13 39	13 51	13 58	14 06	14 15	14 26	14 31	14 36	14 43	14 50	14 58
	11		14 00	14 06	14 12	14 19	14 23	14 27	14 33	14 39	14 42	14 45	14 49	14 53	14 57
	12		14 40	14 41	14 43	14 45	14 46	14 48	14 49	14 51	14 52	14 53	14 54	14 55	14 56
	13		15 19	15 16	15 14	15 11	15 09	15 07	15 05	15 02	15 01	15 00	14 58	14 57	14 55
	14		15 58	15 51	15 44	15 36	15 32	15 27	15 21	15 14	15 11	15 07	15 03	14 59	14 54
	15		16 39	16 28	16 17	16 04	15 57	15 49	15 39	15 27	15 22	15 16	15 10	15 02	14 54
	16		17 22	17 07	16 52	16 34	16 25	16 13	16 00	15 43	15 36	15 27	15 18	15 07	14 55
	17		18 08	17 50	17 31	17 09	16 57	16 42	16 25	16 04	15 54	15 42	15 30	15 15	14 57

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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Oct.	1	16 03	16 13	16 23	16 34	16 40	16 47	16 55	17 05	17 10	17 15	17 20	17 26	17 33
	2	16 55	16 59	17 03	17 08	17 11	17 14	17 17	17 22	17 24	17 26	17 28	17 31	17 33
	3	17 46	17 44	17 43	17 42	17 41	17 40	17 38	17 37	17 36	17 36	17 35	17 34	17 33
	4	18 38	18 31	18 24	18 16	18 11	18 06	18 00	17 53	17 50	17 46	17 42	17 38	17 33
	5	19 32	19 20	19 07	18 53	18 45	18 35	18 25	18 12	18 06	17 59	17 51	17 43	17 34
	6	20 28	20 12	19 54	19 34	19 23	19 09	18 54	18 34	18 25	18 15	18 04	17 51	17 36
	7	21 28	21 08	20 46	20 21	20 07	19 50	19 30	19 05	18 53	18 39	18 24	18 05	17 42
	8	22 30	22 07	21 43	21 15	20 59	20 40	20 17	19 48	19 33	19 16	18 57	18 31	17 58
	9	23 30	23 08	22 43	22 15	21 58	21 39	21 15	20 44	20 29	20 11	19 50	19 22	18 43
	10	.. ..	.. ..	23 44	23 17	23 02	22 44	22 22	21 54	21 39	21 23	21 04	20 40	20 09
	11	0 28	0 07	.. ..	.. ..	.. ..	23 52	23 33	23 09	22 58	22 45	22 30	22 12	21 50
	12	1 22	1 04	0 44	0 21	0 07	.. ..	.. ..	.. ..	.. ..	.. ..	23 57	23 44	23 29
	13	2 12	1 57	1 41	1 22	1 11	0 59	0 44	0 26	0 17	0 08	.. ..	.. ..	.. ..
	14	2 57	2 46	2 34	2 21	2 13	2 04	1 54	1 41	1 35	1 28	1 21	1 12	1 03
	15	3 39	3 32	3 25	3 17	3 12	3 07	3 00	2 53	2 49	2 45	2 41	2 36	2 30
	16	4 19	4 17	4 14	4 11	4 09	4 07	4 05	4 02	4 01	4 00	3 58	3 56	3 54
	17	4 59	5 00	5 02	5 05	5 06	5 07	5 09	5 11	5 11	5 12	5 13	5 15	5 16
	18	5 38	5 44	5 50	5 58	6 02	6 07	6 12	6 19	6 22	6 25	6 29	6 33	6 38
	19	6 19	6 29	6 39	6 52	6 59	7 07	7 16	7 28	7 33	7 39	7 46	7 54	8 02
	20	7 01	7 15	7 30	7 47	7 57	8 08	8 22	8 38	8 46	8 55	9 05	9 16	9 29
	21	7 46	8 03	8 22	8 44	8 56	9 11	9 28	9 50	10 00	10 12	10 25	10 41	11 00
	22	8 34	8 54	9 16	9 42	9 56	10 13	10 34	11 00	11 13	11 28	11 45	12 06	12 33
	23	9 25	9 47	10 11	10 39	10 55	11 13	11 36	12 06	12 20	12 37	12 58	13 23	13 58
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	25	11 13	11 35	11 58	12 25	12 40	12 58	13 20	13 48	14 02	14 17	14 36	14 58	15 27
	26	12 07	12 26	12 47	13 11	13 24	13 40	13 59	14 22	14 34	14 46	15 01	15 18	15 39
	27	12 59	13 15	13 32	13 52	14 02	14 15	14 30	14 48	14 57	15 06	15 17	15 29	15 43
	28	13 51	14 02	14 15	14 29	14 36	14 45	14 56	15 09	15 14	15 21	15 28	15 36	15 45
	29	14 41	14 47	14 55	15 03	15 07	15 12	15 18	15 25	15 29	15 32	15 36	15 41	15 46
	30	15 30	15 32	15 34	15 36	15 37	15 38	15 39	15 41	15 42	15 42	15 43	15 44	15 45
Nov.	31	16 21	16 17	16 13	16 09	16 06	16 03	16 00	15 56	15 54	15 52	15 50	15 48	15 45
	1	17 14	17 05	16 55	16 44	16 38	16 31	16 23	16 13	16 08	16 03	15 58	15 52	15 45
	2	18 10	17 56	17 41	17 23	17 14	17 03	16 49	16 33	16 26	16 18	16 08	15 58	15 46
	3	19 10	18 51	18 31	18 09	17 56	17 41	17 23	17 00	16 50	16 38	16 24	16 08	15 50
	4	20 13	19 51	19 28	19 02	18 46	18 28	18 06	17 38	17 24	17 09	16 51	16 28	16 00
	5	21 17	20 54	20 29	20 01	19 44	19 25	19 01	18 30	18 15	17 57	17 36	17 09	16 30
	6	22 18	21 56	21 32	21 05	20 49	20 30	20 07	19 37	19 22	19 05	18 45	18 19	17 43
	7	23 16	22 56	22 35	22 10	21 56	21 39	21 19	20 54	20 41	20 27	20 10	19 50	19 25
	8	.. ..	23 51	23 34	23 14	23 02	22 49	22 32	22 12	22 03	21 52	21 40	21 25	21 08
	9	0 08	23 56	23 44	23 29	23 22	23 15	23 06	22 56	22 45
	10	0 55	0 43	0 29	0 14	0 06
	11	1 38	1 30	1 22	1 12	1 06	0 59	0 52	0 42	0 38	0 33	0 28	0 22	0 15
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	14	3 38	3 42	3 47	3 53	3 56	3 59	4 04	4 09	4 11	4 14	4 17	4 20	4 23
	15	4 18	4 26	4 36	4 46	4 52	4 59	5 07	5 17	5 22	5 27	5 33	5 39	5 46
	16	4 59	5 12	5 26	5 41	5 50	6 00	6 12	6 27	6 34	6 42	6 51	7 01	7 12
	17	5 44	6 00	6 17	6 38	6 49	7 03	7 19	7 39	7 48	7 59	8 11	8 25	8 42

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Nov.	16	17 22	17 07	16 52	16 34	16 25	16 13	16 00	15 43	15 36	15 27	15 18	15 07	14 55
	17	18 08	17 50	17 31	17 09	16 57	16 42	16 25	16 04	15 54	15 42	15 30	15 15	14 57
	18	18 57	18 36	18 14	17 49	17 34	17 17	16 57	16 31	16 19	16 05	15 48	15 28	15 04
	19	19 49	19 26	19 03	18 35	18 19	18 00	17 37	17 08	16 54	16 38	16 18	15 54	15 21
	20	20 42	20 20	19 56	19 27	19 11	18 52	18 28	17 58	17 43	17 26	17 05	16 39	16 02
	21	21 36	21 15	20 52	20 25	20 10	19 51	19 29	19 01	18 47	18 31	18 12	17 48	17 17
	22	22 29	22 10	21 50	21 26	21 13	20 57	20 38	20 13	20 02	19 49	19 33	19 15	18 53
	23	23 20	23 05	22 48	22 29	22 18	22 06	21 50	21 32	21 23	21 13	21 02	20 49	20 33
	24	...	23 58	23 46	23 33	23 25	23 16	23 05	22 52	22 46	22 39	22 32	22 23	22 14
	25	0 09	...	...	...	...	...	...	...	...	...	...	23 58	23 53
	26	0 58	0 51	0 44	0 36	0 32	0 27	0 21	0 13	0 10	0 06	0 02	...	...
	27	1 45	1 44	1 42	1 41	1 40	1 39	1 37	1 36	1 35	1 34	1 33	1 32	1 31
	28	2 34	2 38	2 42	2 47	2 49	2 52	2 56	3 00	3 02	3 05	3 07	3 10	3 13
	29	3 25	3 34	3 44	3 55	4 02	4 09	4 18	4 28	4 33	4 39	4 45	4 52	4 59
	30	4 21	4 35	4 50	5 07	5 17	5 29	5 43	6 00	6 08	6 17	6 27	6 39	6 53
Dec.	1	5 20	5 39	5 58	6 22	6 35	6 51	7 10	7 33	7 45	7 58	8 13	8 31	8 53
	2	6 24	6 45	7 09	7 36	7 51	8 10	8 32	9 01	9 15	9 32	9 52	10 16	10 50
	3	7 29	7 52	8 16	8 45	9 01	9 20	9 44	10 15	10 30	10 48	11 09	11 36	12 14
	4	8 32	8 54	9 18	9 45	10 00	10 19	10 41	11 09	11 23	11 39	11 58	12 21	12 51
	5	9 31	9 51	10 11	10 35	10 48	11 04	11 23	11 47	11 58	12 11	12 25	12 42	13 03
	6	10 25	10 40	10 57	11 16	11 27	11 39	11 54	12 12	12 21	12 30	12 41	12 53	13 07
	7	11 13	11 24	11 37	11 51	11 59	12 08	12 18	12 31	12 37	12 44	12 51	12 59	13 08
	8	11 57	12 04	12 12	12 21	12 26	12 31	12 38	12 46	12 50	12 54	12 58	13 03	13 08
	9	12 38	12 41	12 44	12 48	12 50	12 52	12 55	12 58	13 00	13 02	13 03	13 05	13 08
	10	13 17	13 16	13 15	13 14	13 13	13 12	13 11	13 10	13 09	13 09	13 08	13 08	13 07
	11	13 56	13 51	13 46	13 39	13 36	13 32	13 27	13 21	13 19	13 16	13 13	13 10	13 06
	12	14 37	14 27	14 17	14 06	14 00	13 53	13 44	13 34	13 30	13 24	13 19	13 13	13 06
	13	15 19	15 06	14 52	14 35	14 27	14 16	14 04	13 49	13 42	13 35	13 26	13 17	13 06
	14	16 04	15 47	15 29	15 09	14 57	14 44	14 28	14 08	13 59	13 49	13 37	13 24	13 08
	15	16 52	16 32	16 11	15 47	15 33	15 17	14 57	14 33	14 21	14 08	13 53	13 35	13 13
	16	17 43	17 21	16 58	16 31	16 16	15 57	15 35	15 07	14 54	14 38	14 19	13 57	13 27
	17	18 37	18 14	17 50	17 22	17 06	16 47	16 23	15 54	15 39	15 22	15 01	14 35	13 59
	18	19 32	19 10	18 46	18 19	18 03	17 45	17 22	16 53	16 39	16 22	16 03	15 38	15 05
	19	20 25	20 06	19 45	19 20	19 06	18 49	18 29	18 04	17 52	17 38	17 21	17 02	16 37
	20	21 17	21 01	20 43	20 23	20 11	19 58	19 41	19 21	19 12	19 01	18 49	18 34	18 17
	21	22 07	21 55	21 41	21 26	21 17	21 07	20 56	20 41	20 34	20 26	20 18	20 08	19 57
	22	22 54	22 47	22 38	22 29	22 23	22 17	22 10	22 01	21 57	21 52	21 47	21 41	21 35
	23	23 41	23 38	23 35	23 31	23 29	23 27	23 24	23 20	23 19	23 17	23 15	23 13	23 11
	24	...	...	...	...	...	...	...	...	...	...	...	...	...
	25	0 28	0 30	0 32	0 34	0 35	0 37	0 39	0 41	0 42	0 43	0 45	0 46	0 48
	26	1 16	1 23	1 30	1 39	1 44	1 50	1 56	2 04	2 08	2 12	2 17	2 22	2 28
	27	2 07	2 19	2 32	2 47	2 55	3 05	3 17	3 31	3 38	3 45	3 54	4 03	4 14
	28	3 03	3 19	3 37	3 58	4 09	4 23	4 40	5 01	5 11	5 22	5 35	5 49	6 07
	29	4 03	4 23	4 45	5 10	5 25	5 42	6 03	6 30	6 43	6 58	7 15	7 37	8 04
	30	5 07	5 29	5 53	6 21	6 37	6 57	7 20	7 50	8 05	8 23	8 44	9 10	9 48
	31	6 11	6 34	6 58	7 26	7 42	8 01	8 24	8 54	9 09	9 26	9 47	10 12	10 47
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LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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Nov.	16	4 59	5 12	5 26	5 41	5 50	6 00	6 12	6 27	6 34	6 42	6 51	7 01	7 12
	17	5 44	6 00	6 17	6 38	6 49	7 03	7 19	7 39	7 48	7 59	8 11	8 25	8 42
	18	6 31	6 50	7 11	7 36	7 49	8 06	8 25	8 50	9 02	9 16	9 32	9 51	10 15
	19	7 21	7 43	8 06	8 33	8 49	9 07	9 29	9 58	10 12	10 28	10 48	11 12	11 44
	20	8 14	8 37	9 01	9 29	9 45	10 05	10 28	10 58	11 13	11 30	11 51	12 17	12 54
	21	9 08	9 30	9 54	10 21	10 37	10 56	11 18	11 47	12 01	12 17	12 36	13 00	13 32
	22	10 02	10 22	10 44	11 08	11 22	11 39	11 59	12 24	12 36	12 50	13 06	13 24	13 47
	23	10 54	11 11	11 29	11 50	12 02	12 16	12 32	12 52	13 01	13 12	13 24	13 37	13 54
	24	11 44	11 57	12 11	12 27	12 36	12 46	12 59	13 13	13 20	13 28	13 36	13 45	13 56
	25	12 32	12 41	12 50	13 01	13 07	13 13	13 21	13 30	13 35	13 39	13 45	13 51	13 57
	26	13 20	13 24	13 28	13 33	13 35	13 38	13 42	13 46	13 48	13 50	13 52	13 54	13 57
	27	14 08	14 07	14 06	14 04	14 04	14 03	14 02	14 00	14 00	13 59	13 58	13 58	13 57
	28	14 58	14 52	14 45	14 37	14 33	14 28	14 22	14 15	14 12	14 09	14 05	14 01	13 57
	29	15 51	15 39	15 27	15 13	15 06	14 57	14 46	14 33	14 27	14 21	14 14	14 06	13 57
	30	16 48	16 32	16 15	15 55	15 44	15 31	15 15	14 56	14 47	14 38	14 26	14 14	13 59
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	2	18 55	18 32	18 09	17 40	17 24	17 05	16 42	16 13	15 58	15 42	15 21	14 57	14 23
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	8	23 59	23 55	23 51	23 46	23 40	23 37	23 34	23 31	23 27	23 23
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	13	2 57	3 08	3 20	3 34	3 42	3 51	4 02	4 15	4 21	4 28	4 36	4 45	4 55
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	19	7 58	8 19	8 41	9 06	9 21	9 38	9 59	10 25	10 38	10 52	11 09	11 29	11 54
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	29	16 33	16 12	15 49	15 22	15 07	14 49	14 27	14 00	13 46	13 31	13 13	12 51	12 23
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	31	18 41	18 19	17 56	17 28	17 13	16 54	16 31	16 01	15 47	15 30	15 10	14 45	14 10
	32	19 41	19 22	19 01	18 37	18 23	18 07	17 47	17 22	17 10	16 56	16 40	16 20	15 56

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date \ Lat.		0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
Jan.	0	^h ^m 21 53	^h ^m 22 04	^h ^m 22 16	^h ^m 22 29	^h ^m 22 36	^h ^m 22 44	^h ^m 22 54	^h ^m 23 06	^h ^m 23 11	^h ^m 23 17	^h ^m 23 24	^h ^m 23 31	^h ^m 23 40
	1	22 44	22 50	22 56	23 03	23 07	23 12	23 17	23 24	23 27	23 30	23 34	23 37	23 42
	2	23 32	23 33	23 35	23 36	23 37	23 38	23 39	23 40	23 40	23 41	23 42	23 43	23 43
	3	...	...	...	...	...	...	...	23 56	23 54	23 52	23 50	23 47	23 45
	4	0 20	0 16	0 12	0 08	0 06	0 03	0 00	...	...	...	23 59	23 53	23 47
	5	1 09	1 00	0 51	0 41	0 35	0 29	0 21	0 12	0 08	0 04	...	...	23 50
	6	1 59	1 46	1 32	1 17	1 08	0 58	0 46	0 32	0 25	0 18	0 09	0 00	23 56
	7	2 52	2 35	2 17	1 57	1 45	1 32	1 16	0 56	0 47	0 36	0 25	0 11	...
	8	3 48	3 28	3 07	2 42	2 28	2 12	1 53	1 28	1 16	1 03	0 48	0 30	0 07
	9	4 46	4 24	4 01	3 34	3 19	3 01	2 39	2 11	1 58	1 42	1 24	1 01	0 32
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	11	6 39	6 18	5 57	5 31	5 17	5 00	4 39	4 13	4 00	3 46	3 29	3 08	2 42
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	13	8 19	8 04	7 49	7 31	7 22	7 10	6 56	6 39	6 31	6 22	6 12	6 00	5 47
	14	9 03	8 53	8 41	8 29	8 21	8 13	8 03	7 51	7 45	7 39	7 32	7 24	7 15
	15	9 45	9 38	9 31	9 23	9 19	9 14	9 08	9 01	8 57	8 54	8 50	8 45	8 40
	16	10 24	10 22	10 20	10 17	10 15	10 13	10 11	10 08	10 07	10 06	10 04	10 03	10 01
	17	11 04	11 05	11 07	11 09	11 10	11 12	11 13	11 15	11 16	11 17	11 18	11 19	11 21
	18	11 43	11 49	11 55	12 02	12 06	12 11	12 16	12 23	12 26	12 29	12 33	12 37	12 42
	19	12 25	12 34	12 45	12 57	13 04	13 11	13 21	13 32	13 37	13 43	13 50	13 57	14 06
	20	13 09	13 22	13 37	13 54	14 03	14 15	14 28	14 44	14 52	15 01	15 10	15 21	15 34
	21	13 57	14 14	14 32	14 53	15 06	15 20	15 37	15 59	16 09	16 21	16 34	16 50	17 08
	22	14 49	15 09	15 31	15 55	16 10	16 27	16 48	17 13	17 26	17 41	17 58	18 18	18 44
	23	15 46	16 08	16 31	16 58	17 14	17 32	17 55	18 23	18 38	18 54	19 14	19 38	20 10
	24	16 46	17 08	17 32	17 58	18 14	18 32	18 55	19 23	19 37	19 53	20 12	20 35	21 06
	25	17 47	18 07	18 29	18 53	19 08	19 24	19 44	20 09	20 21	20 35	20 51	21 09	21 32
	26	18 47	19 04	19 22	19 42	19 54	20 07	20 23	20 43	20 52	21 03	21 14	21 28	21 44
	27	19 44	19 56	20 09	20 25	20 33	20 43	20 55	21 08	21 15	21 22	21 30	21 39	21 49
	28	20 37	20 45	20 53	21 02	21 07	21 13	21 20	21 28	21 32	21 36	21 41	21 46	21 52
	29	21 28	21 30	21 33	21 36	21 38	21 40	21 43	21 46	21 47	21 48	21 50	21 52	21 54
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Feb.	31	23 06	22 59	22 51	22 42	22 38	22 32	22 26	22 18	22 14	22 11	22 06	22 02	21 57
	1	23 56	23 44	23 32	23 18	23 10	23 00	22 49	22 36	22 30	22 24	22 16	22 08	21 59
	2	...	...	...	23 56	23 45	23 32	23 17	22 59	22 50	22 41	22 30	22 18	22 04
	3	0 48	0 32	0 15	23 51	23 28	23 17	23 04	22 50	22 33	22 13
	4	1 43	1 24	1 03	0 39	0 26	0 10	23 54	23 38	23 21	22 59	22 32
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	11	7 41	7 33	7 24	7 15	7 09	7 03	6 56	6 47	6 42	6 38	6 33	6 27	6 21
	12	8 21	8 17	8 13	8 09	8 06	8 03	8 00	7 55	7 53	7 51	7 49	7 46	7 43
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	14	9 40	9 44	9 49	9 54	9 57	10 01	10 05	10 10	10 12	10 14	10 17	10 20	10 24
	15	10 20	10 28	10 37	10 48	10 53	11 00	11 08	11 18	11 22	11 27	11 33	11 39	11 46
	16	11 02	11 14	11 28	11 43	11 51	12 01	12 13	12 28	12 35	12 42	12 51	13 01	13 11

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	0	9 26	9 13	8 59	8 42	8 33	8 22	8 09	7 53	7 46	7 38	7 28	7 18	7 05
	1	10 18	10 09	10 00	9 50	9 44	9 37	9 28	9 18	9 14	9 09	9 03	8 57	8 50
	2	11 07	11 03	10 59	10 55	10 52	10 49	10 46	10 42	10 40	10 38	10 35	10 33	10 30
	3	11 55	11 56	11 58	11 59	12 00	12 01	12 02	12 04	12 04	12 05	12 06	12 07	12 08
	4	12 43	12 49	12 56	13 03	13 08	13 13	13 18	13 25	13 28	13 32	13 36	13 40	13 45
	5	13 32	13 43	13 55	14 08	14 16	14 25	14 35	14 48	14 54	15 00	15 07	15 15	15 25
	6	14 24	14 39	14 55	15 14	15 25	15 37	15 52	16 10	16 19	16 29	16 40	16 52	17 07
	7	15 19	15 37	15 57	16 21	16 34	16 49	17 08	17 32	17 43	17 56	18 11	18 28	18 50
	8	16 16	16 37	16 59	17 25	17 40	17 58	18 19	18 47	19 00	19 15	19 34	19 56	20 24
	9	17 13	17 35	17 58	18 26	18 41	19 00	19 22	19 50	20 04	20 20	20 40	21 03	21 34
	10	18 10	18 31	18 54	19 20	19 34	19 52	20 13	20 40	20 53	21 08	21 25	21 46	22 12
	11	19 04	19 23	19 43	20 06	20 19	20 35	20 54	21 16	21 27	21 39	21 54	22 10	22 30
	12	19 54	20 10	20 27	20 46	20 57	21 10	21 25	21 43	21 52	22 01	22 12	22 24	22 38
	13	20 40	20 53	21 06	21 21	21 29	21 38	21 50	22 03	22 09	22 16	22 24	22 33	22 42
	14	21 23	21 32	21 41	21 51	21 56	22 03	22 10	22 19	22 23	22 28	22 33	22 38	22 45
	15	22 04	22 08	22 13	22 18	22 21	22 24	22 28	22 33	22 35	22 37	22 40	22 43	22 46
	16	22 43	22 44	22 44	22 44	22 45	22 45	22 45	22 45	22 45	22 46	22 46	22 46	22 46
	17	23 23	23 19	23 15	23 10	23 08	23 05	23 02	22 58	22 56	22 54	22 52	22 49	22 47
	18	...	23 55	23 47	23 38	23 32	23 26	23 19	23 11	23 07	23 03	22 58	22 53	22 47
	19	0 03	...	...	...	23 59	23 50	23 39	23 26	23 20	23 14	23 06	22 58	22 49
	20	0 45	0 34	0 21	0 07	...	...	...	23 46	23 37	23 28	23 18	23 06	22 52
	21	1 31	1 16	1 00	0 41	0 30	0 18	0 03	...	...	23 48	23 34	23 18	22 59
	22	2 21	2 03	1 43	1 20	1 07	0 52	0 33	0 11	0 00	...	...	23 40	23 14
	23	3 16	2 55	2 33	2 07	1 52	1 34	1 13	0 46	0 33	0 18	0 01	...	23 49
	24	4 15	3 53	3 29	3 02	2 46	2 27	2 05	1 36	1 21	1 05	0 46	0 21	...
	25	5 16	4 54	4 31	4 05	3 50	3 32	3 10	2 42	2 28	2 12	1 53	1 30	1 00
	26	6 16	5 58	5 37	5 14	5 01	4 45	4 25	4 02	3 50	3 37	3 21	3 03	2 41
	27	7 14	7 00	6 43	6 25	6 14	6 02	5 47	5 29	5 20	5 10	5 00	4 47	4 32
	28	8 09	7 59	7 48	7 35	7 28	7 20	7 10	6 58	6 52	6 46	6 39	6 31	6 22
	29	9 01	8 56	8 50	8 44	8 40	8 36	8 31	8 25	8 22	8 19	8 15	8 11	8 07
Feb.	30	9 51	9 51	9 51	9 51	9 50	9 50	9 50	9 50	9 50	9 49	9 49	9 49	9 49
	31	10 40	10 45	10 50	10 56	11 00	11 03	11 08	11 13	11 16	11 19	11 22	11 25	11 29
	1	11 30	11 40	11 50	12 02	12 08	12 16	12 25	12 37	12 42	12 48	12 54	13 01	13 09
	2	12 21	12 35	12 50	13 07	13 17	13 29	13 43	14 00	14 08	14 16	14 26	14 38	14 51
	3	13 14	13 32	13 51	14 13	14 26	14 41	14 59	15 21	15 32	15 44	15 58	16 14	16 34
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	5	15 06	15 28	15 51	16 19	16 34	16 53	17 15	17 44	17 58	18 14	18 34	18 58	19 29
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	7	16 57	17 17	17 38	18 02	18 16	18 33	18 52	19 17	19 28	19 42	19 57	20 15	20 38
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	9	18 35	18 49	19 03	19 20	19 29	19 40	19 52	20 08	20 15	20 23	20 31	20 41	20 53
	10	19 19	19 29	19 39	19 51	19 58	20 05	20 14	20 25	20 30	20 35	20 41	20 48	20 55
	11	20 00	20 06	20 12	20 19	20 23	20 28	20 33	20 39	20 42	20 45	20 48	20 52	20 56
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	14	21 59	21 52	21 46	21 38	21 34	21 29	21 23	21 16	21 13	21 10	21 06	21 02	20 57
	15	22 40	22 29	22 19	22 06	21 59	21 51	21 42	21 30	21 25	21 19	21 13	21 06	20 58
	16	23 23	23 09	22 54	22 37	22 28	22 16	22 03	21 47	21 40	21 32	21 22	21 12	21 00

MOONRISE, SOUTHERN LATITUDES, 1967
LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date \ Lat.		0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Feb.	15	10 20	10 28	10 37	10 48	10 53	11 00	11 08	11 18	11 22	11 27	11 33	11 39	11 46
	16	11 02	11 14	11 28	11 43	11 51	12 01	12 13	12 28	12 35	12 42	12 51	13 01	13 11
	17	11 47	12 03	12 20	12 40	12 51	13 05	13 20	13 40	13 50	14 00	14 12	14 26	14 42
	18	12 37	12 56	13 16	13 40	13 54	14 10	14 29	14 54	15 05	15 19	15 34	15 53	16 16
	19	13 30	13 52	14 15	14 41	14 56	15 14	15 37	16 05	16 18	16 34	16 54	17 17	17 48
	20	14 28	14 50	15 14	15 41	15 57	16 16	16 39	17 08	17 23	17 39	18 00	18 24	18 58
	21	15 28	15 49	16 12	16 38	16 53	17 11	17 33	18 00	18 13	18 28	18 46	19 08	19 35
	22	16 28	16 47	17 07	17 30	17 43	17 58	18 16	18 39	18 50	19 02	19 16	19 32	19 51
	23	17 26	17 41	17 57	18 15	18 25	18 37	18 51	19 08	19 16	19 25	19 34	19 46	19 59
	24	18 22	18 32	18 43	18 55	19 02	19 10	19 19	19 30	19 35	19 41	19 47	19 54	20 02
	25	19 16	19 21	19 26	19 32	19 35	19 39	19 44	19 49	19 51	19 54	19 57	20 00	20 04
	26	20 07	20 07	20 07	20 06	20 06	20 06	20 06	20 06	20 06	20 05	20 05	20 05	20 05
	27	20 58	20 53	20 47	20 40	20 37	20 33	20 28	20 22	20 20	20 17	20 14	20 10	20 06
	28	21 50	21 39	21 28	21 16	21 09	21 01	20 51	20 40	20 35	20 29	20 23	20 16	20 08
Mar.	1	22 43	22 28	22 12	21 54	21 44	21 32	21 18	21 02	20 54	20 45	20 35	20 24	20 12
	2	23 38	23 19	23 00	22 37	22 24	22 09	21 51	21 29	21 18	21 06	20 53	20 37	20 18
	3	23 51	23 25	23 10	22 52	22 31	22 05	21 52	21 37	21 20	20 59	20 33
	4	0 35	0 13	23 44	23 21	22 52	22 38	22 21	22 02	21 38	21 05
	5	1 31	1 09	0 46	0 18	0 02	23 51	23 37	23 21	23 02	22 38	22 07
	6	2 27	2 06	1 42	1 15	1 00	0 42	0 19	23 57	23 33
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	13	7 38	7 41	7 44	7 48	7 50	7 53	7 56	7 59	8 01	8 02	8 04	8 06	8 09
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	18	11 21	11 42	12 04	12 30	12 44	13 02	13 24	13 51	14 04	14 19	14 38	15 00	15 29
	19	12 15	12 37	13 01	13 29	13 45	14 04	14 27	14 56	15 11	15 28	15 48	16 14	16 49
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	23	16 05	16 17	16 31	16 47	16 55	17 05	17 17	17 31	17 38	17 45	17 53	18 03	18 13
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	26	18 43	18 41	18 38	18 34	18 32	18 30	18 28	18 25	18 23	18 22	18 20	18 19	18 17
	27	19 36	19 28	19 19	19 10	19 04	18 58	18 51	18 42	18 38	18 34	18 29	18 24	18 18
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	30	22 25	22 05	21 43	21 18	21 03	20 46	20 26	20 01	19 48	19 34	19 18	18 59	18 36
	31	23 24	23 02	22 38	22 11	21 55	21 36	21 14	20 45	20 31	20 14	19 55	19 31	19 00
Apr.	1	23 36	23 09	22 53	22 34	22 11	21 42	21 27	21 10	20 51	20 26	19 52
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LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Lat. Date		0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		^h _m	^h _m	^h _m	^h _m	^h _m	^h _m	^h _m	^h _m	^h _m	^h _m	^h _m	^h _m	^h _m
Feb.	15	22 40	22 29	22 19	22 06	21 59	21 51	21 42	21 30	21 25	21 19	21 13	21 06	20 58
	16	23 23	23 09	22 54	22 37	22 28	22 16	22 03	21 47	21 40	21 32	21 22	21 12	21 00
	17	23 53	23 34	23 13	23 01	22 47	22 30	22 09	21 59	21 48	21 36	21 21	21 04
	18	0 11	23 55	23 41	23 24	23 04	22 39	22 26	22 13	21 57	21 37	21 14
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	21	2 56	2 34	2 11	1 43	1 28	1 09	0 46	0 17	0 02	23 56
	22	3 57	3 36	3 15	2 49	2 34	2 17	1 56	1 30	1 17	1 02	0 44	0 23
	23	4 56	4 39	4 21	4 00	3 47	3 33	3 15	2 54	2 44	2 32	2 19	2 03	1 45
	24	5 53	5 41	5 27	5 11	5 02	4 52	4 39	4 24	4 17	4 09	4 00	3 50	3 38
	25	6 48	6 40	6 32	6 22	6 17	6 11	6 03	5 54	5 50	5 45	5 40	5 35	5 28
	26	7 40	7 38	7 35	7 32	7 30	7 28	7 26	7 23	7 22	7 20	7 19	7 17	7 15
	27	8 31	8 34	8 37	8 41	8 43	8 45	8 48	8 51	8 52	8 54	8 56	8 58	9 00
	28	9 23	9 31	9 39	9 49	9 55	10 01	10 09	10 18	10 22	10 27	10 32	10 38	10 45
Mar.	1	10 15	10 28	10 42	10 57	11 06	11 17	11 29	11 44	11 52	11 59	12 08	12 18	12 30
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	13	19 57	19 52	19 47	19 41	19 37	19 33	19 29	19 23	19 21	19 18	19 15	19 12	19 08
	14	20 37	20 28	20 19	20 08	20 02	19 55	19 46	19 36	19 32	19 27	19 21	19 15	19 08
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	17	22 54	22 34	22 14	21 50	21 36	21 20	21 01	20 37	20 25	20 12	19 58	19 40	19 18
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	25	5 24	5 18	5 13	5 06	5 02	4 58	4 53	4 47	4 44	4 41	4 37	4 34	4 29
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Apr.	1	11 52	12 14	12 38	13 06	13 22	13 41	14 04	14 33	14 48	15 04	15 24	15 49	16 23
	2	12 48	13 10	13 33	13 59	14 14	14 32	14 54	15 21	15 34	15 50	16 07	16 29	16 57

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Lat. Date		0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr.	1	23 36	23 09	22 53	22 34	22 11	21 42	21 27	21 10	20 51	20 26	19 52
	2	0 22	0 00	23 54	23 36	23 15	22 48	22 35	22 20	22 03	21 41	21 14
	3	1 16	0 56	0 34	0 08	23 50	23 38	23 24	23 07	22 48
	4	2 07	1 50	1 30	1 08	0 56	0 41	0 23	0 01
	5	2 54	2 40	2 25	2 07	1 57	1 45	1 31	1 13	1 05	0 56	0 46	0 34	0 20
	6	3 38	3 28	3 16	3 03	2 56	2 47	2 37	2 25	2 19	2 13	2 06	1 58	1 49
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	9	5 38	5 40	5 41	5 43	5 45	5 46	5 48	5 50	5 50	5 51	5 52	5 54	5 55
	10	6 17	6 23	6 29	6 36	6 40	6 45	6 51	6 57	7 00	7 04	7 07	7 11	7 16
	11	6 58	7 08	7 18	7 31	7 37	7 45	7 55	8 06	8 11	8 17	8 24	8 31	8 40
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	13	8 27	8 44	9 02	9 24	9 36	9 51	10 08	10 29	10 40	10 51	11 05	11 20	11 39
	14	9 16	9 36	9 58	10 23	10 37	10 54	11 15	11 41	11 54	12 08	12 26	12 46	13 13
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	28	22 10	21 48	21 24	20 56	20 40	20 21	19 58	19 28	19 13	18 57	18 36	18 11	17 37
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May	1	0 02	23 59	23 48	23 35	23 20	23 01	22 51	22 41	22 30	22 16	22 01
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	17	12 37	12 49	13 02	13 17	13 25	13 35	13 46	13 59	14 05	14 12	14 20	14 28	14 38
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LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
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Apr.	1	11 52	12 14	12 38	13 06	13 22	13 41	14 04	14 33	14 48	15 04	15 24	15 49	16 23
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	3	13 41	14 01	14 21	14 45	14 58	15 14	15 32	15 56	16 07	16 19	16 34	16 51	17 11
	4	14 31	14 47	15 04	15 23	15 34	15 47	16 02	16 21	16 30	16 39	16 50	17 03	17 17
	5	15 16	15 28	15 42	15 56	16 05	16 15	16 26	16 40	16 46	16 53	17 01	17 10	17 20
	6	15 58	16 07	16 16	16 26	16 32	16 38	16 46	16 55	16 59	17 04	17 09	17 15	17 21
	7	16 39	16 43	16 48	16 53	16 56	16 59	17 03	17 08	17 10	17 12	17 15	17 18	17 21
	8	17 18	17 18	17 18	17 19	17 19	17 19	17 20	17 20	17 20	17 20	17 20	17 21	17 21
	9	17 57	17 53	17 49	17 44	17 42	17 39	17 36	17 32	17 30	17 28	17 26	17 23	17 20
	10	18 37	18 29	18 20	18 11	18 06	18 00	17 53	17 44	17 40	17 36	17 31	17 26	17 20
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	13	20 50	20 32	20 12	19 49	19 36	19 20	19 02	18 40	18 29	18 17	18 03	17 47	17 27
	14	21 41	21 20	20 58	20 31	20 17	19 59	19 38	19 11	18 58	18 43	18 25	18 04	17 37
	15	22 35	22 13	21 49	21 21	21 05	20 46	20 23	19 54	19 39	19 22	19 02	18 37	18 03
	16	23 31	23 09	22 46	22 18	22 02	21 43	21 20	20 51	20 36	20 19	19 59	19 34	18 59
	17	23 46	23 21	23 06	22 49	22 28	22 02	21 49	21 34	21 17	20 56	20 29
	18	0 28	0 08	23 43	23 22	23 12	23 00	22 47	22 31	22 13
	19	1 23	1 06	0 48	0 27	0 15	0 00
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	23	4 52	4 54	4 57	5 00	5 02	5 04	5 06	5 09	5 11	5 12	5 14	5 15	5 17
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	29	10 38	11 00	11 24	11 51	12 07	12 25	12 48	13 16	13 30	13 46	14 05	14 29	15 00
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May	1	12 26	12 43	13 02	13 23	13 35	13 49	14 05	14 26	14 35	14 46	14 58	15 12	15 29
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	4	14 38	14 44	14 50	14 57	15 01	15 05	15 10	15 17	15 19	15 22	15 26	15 30	15 34
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	9	18 00	17 46	17 31	17 14	17 04	16 52	16 39	16 23	16 15	16 07	15 58	15 47	15 35
	10	18 47	18 30	18 11	17 49	17 37	17 22	17 05	16 44	16 34	16 23	16 10	15 56	15 38
	11	19 38	19 17	18 56	18 30	18 16	17 59	17 38	17 13	17 00	16 46	16 30	16 10	15 46
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	16	...	23 56	23 41	23 23	23 13	23 01	22 47	22 29	22 21	22 12	22 01	21 49	21 35
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	18	1 01	0 52	0 41	0 29	0 22	0 14	0 04

Date \ Lat.		0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°	
		<small>h m</small>	<small>h m</small>	<small>h m</small>	<small>h m</small>	<small>h m</small>	<small>h m</small>	<small>h m</small>	<small>h m</small>	<small>h m</small>	<small>h m</small>	<small>h m</small>	<small>h m</small>	<small>h m</small>	
May	17	12 37	12 49	13 02	13 17	13 25	13 35	13 46	13 59	14 05	14 12	14 20	14 28	14 38	
	18	13 28	13 35	13 43	13 52	13 57	14 02	14 09	14 17	14 20	14 24	14 29	14 34	14 39	
	19	14 17	14 19	14 22	14 25	14 26	14 28	14 30	14 33	14 34	14 35	14 37	14 38	14 40	
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	21	15 58	15 50	15 41	15 32	15 26	15 20	15 13	15 05	15 01	14 57	14 52	14 47	14 41	
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	23	17 49	17 32	17 14	16 53	16 41	16 27	16 10	15 50	15 41	15 30	15 18	15 04	14 48	
	24	18 50	18 29	18 08	17 42	17 28	17 11	16 50	16 25	16 12	15 59	15 42	15 23	15 26	
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	June	1	0 56	0 51	0 45	0 39	0 35	0 31	0 26	0 20	0 17	0 14	0 11	0 07	0 03
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LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
May	17	0 10	23 53	23 47	23 41	23 34	23 27	23 18
	18	1 01	0 52	0 41	0 29	0 22	0 14	0 04
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	29	11 07	11 22	11 38	11 56	12 07	12 19	12 33	12 51	12 59	13 08	13 18	13 29	13 42
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June	1	13 15	13 18	13 22	13 26	13 28	13 30	13 33	13 36	13 38	13 39	13 41	13 43	13 46
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	15
	16	0 35	0 34	0 32	0 30	0 29	0 28	0 26	0 24	0 24	0 23	0 22	0 21	0 19
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	24	8 03	8 23	8 44	9 08	9 22	9 39	9 58	10 22	10 34	10 47	11 03	11 20	11 42
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	29	11 51	11 51	11 52	11 53	11 53	11 54	11 54	11 55	11 55	11 55	11 55	11 56	11 56
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July	1	13 10	13 02	12 54	12 45	12 40	12 34	12 27	12 19	12 15	12 11	12 07	12 02	11 56
	2	13 52	13 40	13 28	13 14	13 06	12 57	12 46	12 33	12 27	12 21	12 14	12 06	11 57

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Lat. Date		0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
July	1	h m 0 51	h m 0 56	h m 1 02	h m 1 09	h m 1 13	h m 1 17	h m 1 23	h m 1 29	h m 1 32	h m 1 35	h m 1 39	h m 1 43	h m 1 47
	2	1 31	1 41	1 51	2 03	2 10	2 17	2 27	2 38	2 43	2 49	2 55	3 03	3 11
	3	2 14	2 28	2 42	2 59	3 08	3 19	3 33	3 49	3 57	4 05	4 15	4 26	4 38
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	6	4 45	5 06	5 30	5 57	6 13	6 32	6 55	7 23	7 38	7 55	8 14	8 39	9 13
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	13	10 58	10 59	10 59	11 00	11 00	11 00	11 01	11 01	11 01	11 01	11 02	11 02	11 02
	14	11 46	11 42	11 37	11 31	11 28	11 25	11 21	11 16	11 14	11 11	11 09	11 06	11 03
	15	12 36	12 26	12 16	12 05	11 59	11 51	11 43	11 33	11 28	11 23	11 17	11 11	11 04
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	17	14 23	14 05	13 46	13 24	13 11	12 57	12 40	12 18	12 08	11 57	11 44	11 29	11 12
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	21	18 19	18 00	17 38	17 14	17 00	16 43	16 23	15 58	15 45	15 31	15 15	14 55	14 30
	22	19 12	18 56	18 38	18 18	18 06	17 52	17 36	17 15	17 06	16 55	16 42	16 28	16 11
	23	20 01	19 48	19 35	19 19	19 10	19 00	18 47	18 33	18 25	18 18	18 09	17 59	17 48
	24	20 45	20 37	20 28	20 17	20 11	20 05	19 57	19 47	19 42	19 37	19 32	19 25	19 18
	25	21 27	21 23	21 18	21 13	21 10	21 07	21 03	20 58	20 56	20 53	20 50	20 47	20 44
	26	22 07	22 07	22 07	22 07	22 07	22 07	22 07	22 07	22 06	22 06	22 06	22 06	22 06
	27	22 46	22 50	22 55	23 00	23 03	23 06	23 10	23 14	23 16	23 19	23 21	23 24	23 28
	28	23 26	23 34	23 43	23 53	23 59
	29	0 06	0 13	0 23	0 27	0 32	0 37	0 43	0 50
	30	0 08	0 20	0 33	0 48	0 57	1 07	1 18	1 33	1 39	1 47	1 55	2 05	2 16
Aug.	31	0 53	1 08	1 25	1 45	1 56	2 09	2 25	2 44	2 54	3 04	3 16	3 29	3 46
	1	1 41	2 00	2 20	2 44	2 57	3 13	3 33	3 57	4 09	4 22	4 38	4 57	5 20
	2	2 33	2 54	3 17	3 44	3 59	4 17	4 39	5 08	5 21	5 38	5 57	6 20	6 52
	3	3 28	3 51	4 15	4 43	4 59	5 18	5 41	6 11	6 26	6 43	7 04	7 30	8 06
	4	4 26	4 48	5 11	5 39	5 54	6 12	6 35	7 03	7 17	7 33	7 52	8 15	8 45
	5	5 24	5 44	6 05	6 29	6 43	6 59	7 18	7 42	7 54	8 07	8 22	8 40	9 02
	6	6 20	6 37	6 54	7 13	7 24	7 37	7 53	8 11	8 20	8 30	8 41	8 54	9 08
	7	7 14	7 26	7 38	7 53	8 01	8 10	8 21	8 34	8 40	8 46	8 54	9 02	9 11
	8	8 05	8 12	8 20	8 28	8 33	8 38	8 44	8 52	8 55	8 59	9 03	9 07	9 12
	9	8 55	8 57	8 59	9 01	9 02	9 04	9 05	9 07	9 08	9 09	9 10	9 12	9 13
	10	9 43	9 40	9 37	9 33	9 31	9 28	9 26	9 22	9 21	9 19	9 17	9 15	9 13
	11	10 33	10 25	10 16	10 06	10 01	9 55	9 47	9 38	9 34	9 30	9 25	9 20	9 14
	12	11 24	11 11	10 58	10 42	10 33	10 23	10 11	9 57	9 51	9 43	9 35	9 26	9 16
	13	12 18	12 01	11 43	11 22	11 11	10 57	10 41	10 21	10 11	10 01	9 49	9 35	9 19
	14	13 16	12 55	12 33	12 09	11 54	11 37	11 17	10 52	10 40	10 26	10 10	9 52	9 28
	15	14 15	13 52	13 29	13 01	12 45	12 27	12 04	11 35	11 21	11 05	10 45	10 21	9 50
	16	15 14	14 52	14 27	14 00	13 44	13 25	13 02	12 32	12 18	12 01	11 40	11 15	10 40
	17	16 11	15 50	15 28	15 02	14 47	14 30	14 08	13 41	13 28	13 13	12 55	12 33	12 05

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July	1	13 10	13 02	12 54	12 45	12 40	12 34	12 27	12 19	12 15	12 11	12 07	12 02	11 56
	2	13 52	13 40	13 28	13 14	13 06	12 57	12 46	12 33	12 27	12 21	12 14	12 06	11 57
	3	14 36	14 21	14 05	13 46	13 35	13 23	13 09	12 51	12 43	12 34	12 24	12 12	11 59
	4	15 24	15 06	14 46	14 23	14 10	13 55	13 37	13 14	13 04	12 52	12 38	12 22	12 03
	5	16 16	15 55	15 33	15 07	14 52	14 34	14 13	13 47	13 33	13 19	13 01	12 40	12 14
	6	17 12	16 50	16 26	15 58	15 42	15 23	15 00	14 31	14 16	14 00	13 39	13 14	12 40
	7	18 09	17 47	17 24	16 57	16 41	16 22	15 59	15 30	15 15	14 59	14 39	14 14	13 40
	8	19 07	18 47	18 25	18 01	17 46	17 29	17 08	16 42	16 30	16 15	15 58	15 38	15 12
	9	20 02	19 45	19 27	19 07	18 55	18 41	18 24	18 03	17 53	17 42	17 29	17 14	16 57
	10	20 55	20 42	20 29	20 14	20 05	19 54	19 42	19 27	19 20	19 12	19 04	18 54	18 42
	11	21 45	21 37	21 29	21 19	21 14	21 07	21 00	20 51	20 47	20 42	20 37	20 31	20 25
	12	22 33	22 30	22 27	22 24	22 22	22 19	22 17	22 13	22 12	22 10	22 08	22 06	22 04
	13	23 21	23 23	23 26	23 28	23 29	23 31	23 33	23 35	23 36	23 38	23 39	23 40	23 42
	14	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
	15	0 10	0 17	0 24	0 33	0 38	0 44	0 50	0 58	1 02	1 06	1 11	1 16	1 22
	16	1 00	1 12	1 25	1 40	1 48	1 58	2 09	2 23	2 29	2 37	2 45	2 54	3 05
	17	1 54	2 10	2 28	2 48	2 59	3 13	3 29	3 49	3 58	4 09	4 21	4 35	4 52
	18	2 51	3 11	3 32	3 56	4 10	4 27	4 47	5 13	5 25	5 39	5 56	6 15	6 40
	19	3 51	4 13	4 36	5 03	5 19	5 38	6 00	6 29	6 43	7 00	7 19	7 44	8 16
	20	4 51	5 13	5 37	6 05	6 21	6 40	7 02	7 31	7 46	8 02	8 22	8 46	9 19
	21	5 50	6 11	6 33	6 59	7 14	7 31	7 52	8 18	8 30	8 45	9 02	9 22	9 47
	22	6 45	7 03	7 23	7 45	7 58	8 12	8 30	8 51	9 01	9 13	9 26	9 41	9 59
	23	7 36	7 51	8 06	8 24	8 34	8 45	8 59	9 15	9 23	9 31	9 41	9 52	10 04
	24	8 23	8 33	8 44	8 57	9 04	9 12	9 22	9 33	9 38	9 44	9 51	9 58	10 06
	25	9 06	9 12	9 19	9 26	9 30	9 35	9 41	9 48	9 51	9 54	9 58	10 02	10 07
	26	9 46	9 49	9 51	9 53	9 55	9 56	9 58	10 00	10 01	10 03	10 04	10 05	10 07
	27	10 26	10 24	10 22	10 19	10 18	10 16	10 14	10 12	10 11	10 10	10 09	10 08	10 06
	28	11 05	10 59	10 53	10 45	10 41	10 37	10 31	10 24	10 21	10 18	10 15	10 11	10 06
	29	11 46	11 36	11 25	11 13	11 06	10 58	10 49	10 38	10 33	10 27	10 21	10 14	10 06
	30	12 29	12 15	12 00	11 43	11 34	11 23	11 10	10 54	10 47	10 38	10 29	10 19	10 07
Aug.	31	13 15	12 58	12 39	12 18	12 06	11 52	11 35	11 15	11 05	10 54	10 41	10 27	10 10
	1	14 05	13 45	13 23	12 59	12 44	12 27	12 07	11 42	11 30	11 16	11 00	10 41	10 17
	2	14 59	14 37	14 14	13 46	13 31	13 12	12 49	12 21	12 07	11 50	11 31	11 07	10 35
	3	15 56	15 34	15 10	14 42	14 26	14 07	13 43	13 13	12 59	12 41	12 21	11 55	11 19
	4	16 54	16 33	16 11	15 44	15 29	15 11	14 49	14 21	14 08	13 52	13 33	13 10	12 40
	5	17 51	17 33	17 14	16 51	16 38	16 22	16 04	15 41	15 30	15 17	15 03	14 45	14 24
	6	18 46	18 32	18 17	18 00	17 49	17 37	17 23	17 06	16 58	16 49	16 39	16 27	16 13
	7	19 39	19 29	19 19	19 07	19 01	18 53	18 44	18 32	18 27	18 21	18 15	18 08	18 00
	8	20 29	20 24	20 20	20 14	20 11	20 07	20 03	19 58	19 55	19 53	19 50	19 47	19 43
	9	21 18	21 18	21 19	21 20	21 20	21 21	21 21	21 22	21 22	21 23	21 23	21 23	21 24
	10	22 07	22 13	22 19	22 26	22 30	22 34	22 40	22 46	22 49	22 52	22 56	23 00	23 05
	11	22 57	23 08	23 19	23 32	23 40	23 48	23 59	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
	12	23 50	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 11	0 17	0 23	0 30	0 39	0 48
	13	.. ..	0 05	0 21	0 40	0 51	1 03	1 18	1 37	1 46	1 55	2 07	2 19	2 34
	14	0 45	1 04	1 25	1 48	2 02	2 18	2 37	3 01	3 13	3 26	3 41	4 00	4 22
	15	1 44	2 05	2 28	2 55	3 10	3 29	3 51	4 19	4 33	4 49	5 08	5 32	6 03
	16	2 43	3 05	3 30	3 57	4 13	4 32	4 56	5 25	5 40	5 57	6 17	6 43	7 17
	17	3 42	4 03	4 26	4 53	5 08	5 26	5 48	6 16	6 29	6 45	7 03	7 25	7 54

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)

MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Aug.	16	15 14	14 52	14 27	14 00	13 44	13 25	13 02	12 32	12 18	12 01	11 40	11 15	10 40
	17	16 11	15 50	15 28	15 02	14 47	14 30	14 08	13 41	13 28	13 13	12 55	12 33	12 05
	18	17 05	16 47	16 28	16 06	15 53	15 38	15 20	14 57	14 47	14 34	14 20	14 04	13 44
	19	17 54	17 40	17 25	17 07	16 57	16 46	16 32	16 15	16 07	15 58	15 47	15 36	15 22
	20	18 40	18 30	18 19	18 07	18 00	17 51	17 42	17 30	17 24	17 18	17 12	17 04	16 55
	21	19 23	19 17	19 10	19 03	18 59	18 54	18 49	18 42	18 39	18 36	18 32	18 28	18 23
	22	20 03	20 01	20 00	19 58	19 57	19 55	19 54	19 52	19 51	19 50	19 49	19 48	19 47
	23	20 43	20 45	20 48	20 51	20 53	20 55	20 58	21 01	21 02	21 03	21 05	21 07	21 09
	24	21 22	21 29	21 36	21 45	21 49	21 55	22 01	22 09	22 12	22 16	22 20	22 25	22 31
	25	22 03	22 14	22 26	22 39	22 46	22 55	23 05	23 18	23 24	23 30	23 37	23 46	23 55
	26	22 46	23 01	23 16	23 35	23 45	23 57	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
	27	23 32	23 50	.. ..	.. ..	.. ..	.. ..	0 11	0 29	0 37	0 46	0 57	1 09	1 23
	28	.. ..	.. ..	0 09	0 32	0 45	1 00	1 18	1 40	1 51	2 04	2 18	2 35	2 55
	29	0 22	0 43	1 05	1 31	1 45	2 03	2 24	2 51	3 05	3 20	3 38	4 00	4 29
	30	1 15	1 38	2 01	2 29	2 45	3 04	3 28	3 58	4 12	4 29	4 50	5 16	5 53
Sept.	31	2 11	2 34	2 58	3 26	3 42	4 01	4 24	4 54	5 08	5 25	5 46	6 11	6 46
	1	3 09	3 30	3 52	4 18	4 33	4 50	5 11	5 38	5 51	6 06	6 23	6 43	7 09
	2	4 06	4 24	4 43	5 05	5 17	5 32	5 50	6 11	6 21	6 33	6 46	7 01	7 19
	3	5 01	5 15	5 30	5 47	5 56	6 07	6 20	6 36	6 43	6 51	7 00	7 11	7 22
	4	5 54	6 03	6 13	6 24	6 30	6 37	6 46	6 56	7 00	7 05	7 11	7 17	7 24
	5	6 45	6 49	6 53	6 58	7 01	7 04	7 08	7 12	7 14	7 16	7 19	7 21	7 24
	6	7 35	7 34	7 33	7 32	7 31	7 30	7 29	7 28	7 27	7 26	7 26	7 25	7 24
	7	8 26	8 20	8 13	8 05	8 01	7 56	7 50	7 44	7 40	7 37	7 33	7 29	7 25
	8	9 18	9 07	8 55	8 41	8 33	8 24	8 14	8 01	7 56	7 49	7 42	7 34	7 26
	9	10 13	9 57	9 40	9 20	9 09	8 57	8 42	8 23	8 15	8 05	7 55	7 42	7 28
	10	11 10	10 51	10 29	10 06	9 52	9 35	9 16	8 52	8 41	8 28	8 13	7 56	7 34
	11	12 09	11 47	11 24	10 57	10 41	10 22	10 00	9 32	9 18	9 02	8 43	8 20	7 50
	12	13 09	12 46	12 22	11 54	11 37	11 18	10 55	10 25	10 10	9 53	9 32	9 06	8 30
	13	14 06	13 45	13 22	12 55	12 39	12 21	11 59	11 30	11 16	11 01	10 41	10 17	9 46
	14	15 01	14 41	14 21	13 58	13 44	13 28	13 09	12 44	12 33	12 19	12 04	11 46	11 23
	15	15 51	15 35	15 18	14 59	14 48	14 35	14 20	14 01	13 52	13 42	13 30	13 17	13 02
	16	16 37	16 25	16 13	15 59	15 50	15 41	15 30	15 16	15 10	15 03	14 55	14 46	14 36
	17	17 20	17 13	17 05	16 56	16 50	16 44	16 37	16 29	16 25	16 21	16 16	16 11	16 05
	18	18 01	17 58	17 54	17 50	17 48	17 46	17 43	17 39	17 38	17 36	17 34	17 32	17 29
	19	18 40	18 42	18 43	18 44	18 45	18 46	18 47	18 48	18 49	18 49	18 50	18 51	18 52
	20	19 20	19 25	19 31	19 37	19 41	19 45	19 50	19 56	19 59	20 02	20 06	20 09	20 14
	21	20 00	20 10	20 20	20 31	20 38	20 45	20 54	21 05	21 10	21 16	21 22	21 29	21 37
	22	20 42	20 56	21 10	21 26	21 36	21 47	22 00	22 15	22 23	22 31	22 41	22 52	23 04
	23	21 27	21 44	22 02	22 23	22 35	22 49	23 06	23 27	23 37	23 48	.. ..	.. ..	.. ..
	24	22 15	22 34	22 56	23 21	23 35	23 52	.. ..	.. ..	.. ..	.. ..	0 01	0 16	0 34
	25	23 06	23 28	23 51	.. ..	.. ..	.. ..	0 12	0 38	0 50	1 05	1 22	1 42	2 08
	26	.. ..	.. ..	.. ..	0 19	0 34	0 53	1 16	1 45	2 00	2 17	2 37	3 02	3 37
	27	0 00	0 22	0 46	1 15	1 31	1 51	2 14	2 45	3 00	3 17	3 39	4 06	4 44
	28	0 55	1 17	1 40	2 08	2 23	2 42	3 04	3 33	3 47	4 03	4 22	4 45	5 16
	29	1 51	2 10	2 32	2 56	3 09	3 26	3 45	4 09	4 21	4 34	4 49	5 07	5 29
Oct.	30	2 46	3 02	3 19	3 39	3 50	4 03	4 18	4 37	4 46	4 56	5 06	5 19	5 34
	1	3 39	3 51	4 03	4 17	4 25	4 34	4 45	4 58	5 04	5 11	5 18	5 26	5 36
	2	4 30	4 37	4 44	4 53	4 57	5 02	5 08	5 16	5 19	5 23	5 27	5 31	5 36

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Aug.	16	2 43	3 05	3 30	3 57	4 13	4 32	4 56	5 25	5 40	5 57	6 17	6 43	7 17
	17	3 42	4 03	4 26	4 53	5 08	5 26	5 48	6 16	6 29	6 45	7 03	7 25	7 54
	18	4 37	4 57	5 17	5 41	5 54	6 10	6 29	6 52	7 04	7 16	7 31	7 48	8 08
	19	5 29	5 45	6 02	6 22	6 32	6 45	7 00	7 19	7 27	7 37	7 48	8 00	8 14
	20	6 17	6 29	6 42	6 56	7 04	7 14	7 25	7 38	7 44	7 51	7 59	8 07	8 17
	21	7 01	7 09	7 17	7 27	7 32	7 38	7 45	7 54	7 58	8 02	8 07	8 12	8 18
	22	7 42	7 46	7 50	7 54	7 57	8 00	8 03	8 07	8 09	8 11	8 13	8 15	8 18
	23	8 22	8 22	8 21	8 21	8 20	8 20	8 19	8 19	8 18	8 18	8 18	8 17	8 17
	24	9 02	8 57	8 52	8 46	8 43	8 40	8 36	8 31	8 28	8 26	8 23	8 20	8 17
	25	9 42	9 33	9 24	9 13	9 07	9 01	8 53	8 43	8 39	8 34	8 29	8 23	8 16
	26	10 24	10 11	9 58	9 42	9 34	9 24	9 12	8 58	8 51	8 44	8 36	8 27	8 17
	27	11 08	10 52	10 34	10 15	10 03	9 50	9 35	9 16	9 07	8 57	8 46	8 33	8 18
	28	11 56	11 36	11 16	10 52	10 38	10 23	10 04	9 40	9 29	9 16	9 01	8 44	8 23
	29	12 47	12 26	12 03	11 36	11 21	11 02	10 40	10 13	9 59	9 44	9 25	9 03	8 34
	30	13 42	13 19	12 55	12 27	12 11	11 52	11 28	10 58	10 43	10 26	10 05	9 39	9 02
Sept.	31	14 39	14 17	13 53	13 26	13 10	12 51	12 28	11 59	11 44	11 27	11 07	10 42	10 07
	1	15 36	15 16	14 55	14 30	14 16	13 59	13 39	13 13	13 01	12 46	12 29	12 09	11 44
	2	16 32	16 14	15 59	15 38	15 27	15 13	14 57	14 37	14 27	14 16	14 04	13 49	13 32
	3	17 26	17 14	17 02	16 47	16 39	16 29	16 18	16 04	15 57	15 50	15 42	15 32	15 22
	4	18 18	18 12	18 04	17 56	17 51	17 46	17 39	17 31	17 28	17 24	17 19	17 14	17 09
	5	19 09	19 07	19 06	19 04	19 03	19 02	19 00	18 59	18 58	18 57	18 56	18 55	18 54
	6	19 59	20 03	20 07	20 12	20 15	20 18	20 21	20 25	20 27	20 30	20 32	20 35	20 38
	7	20 51	21 00	21 09	21 21	21 27	21 34	21 43	21 53	21 58	22 03	22 09	22 16	22 24
	8	21 44	21 58	22 13	22 30	22 40	22 51	23 05	23 21	23 29	23 38	23 48	...	...
	9	22 40	22 58	23 18	23 40	23 53	...	...	...	...	...	...	0 00	0 13
	10	23 38	23 59	...	...	...	0 08	0 26	0 49	1 00	1 12	1 27	1 43	2 04
	11	...	...	0 22	0 48	1 03	1 21	1 43	2 11	2 24	2 40	2 59	3 21	3 51
	12	0 38	1 00	1 25	1 52	2 09	2 28	2 51	3 21	3 36	3 53	4 14	4 40	5 16
	13	1 37	1 59	2 23	2 50	3 06	3 25	3 47	4 16	4 30	4 47	5 06	5 30	6 02
	14	2 33	2 53	3 15	3 40	3 54	4 11	4 31	4 56	5 08	5 22	5 37	5 56	6 19
	15	3 25	3 42	4 01	4 22	4 34	4 48	5 04	5 24	5 34	5 44	5 57	6 10	6 27
	16	4 13	4 27	4 41	4 57	5 07	5 17	5 30	5 45	5 52	6 00	6 08	6 18	6 29
	17	4 58	5 07	5 18	5 29	5 35	5 42	5 51	6 01	6 06	6 11	6 17	6 23	6 30
	18	5 40	5 45	5 51	5 57	6 00	6 04	6 09	6 15	6 17	6 20	6 23	6 26	6 30
	19	6 20	6 21	6 22	6 23	6 24	6 25	6 25	6 26	6 27	6 27	6 28	6 29	6 29
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	21	7 39	7 32	7 24	7 15	7 10	7 05	6 58	6 50	6 46	6 43	6 38	6 33	6 28
	22	8 20	8 09	7 57	7 43	7 35	7 27	7 16	7 04	6 58	6 52	6 44	6 36	6 27
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	24	9 50	9 31	9 12	8 49	8 36	8 21	8 03	7 41	7 31	7 19	7 05	6 50	6 31
Oct.	25	10 39	10 18	9 56	9 29	9 15	8 57	8 36	8 10	7 57	7 42	7 25	7 04	6 38
	26	11 31	11 09	10 45	10 17	10 01	9 42	9 18	8 49	8 34	8 17	7 57	7 31	6 56
	27	12 26	12 04	11 39	11 11	10 55	10 35	10 12	9 41	9 26	9 09	8 48	8 21	7 42
	28	13 22	13 01	12 38	12 12	11 57	11 38	11 16	10 49	10 35	10 19	10 00	9 37	9 06
	29	14 17	13 59	13 39	13 17	13 04	12 48	12 30	12 07	11 56	11 43	11 28	11 11	10 50
	30	15 11	14 57	14 42	14 24	14 14	14 02	13 48	13 31	13 23	13 14	13 03	12 52	12 38
	1	16 03	15 54	15 44	15 32	15 26	15 18	15 09	14 58	14 53	14 47	14 41	14 33	14 25
	2	16 55	16 50	16 46	16 41	16 38	16 34	16 30	16 25	16 23	16 20	16 18	16 15	16 11

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct.	1	3 39	3 51	4 03	4 17	4 25	4 34	4 45	4 58	5 04	5 11	5 18	5 26	5 36
	2	4 30	4 37	4 44	4 53	4 57	5 02	5 08	5 16	5 19	5 23	5 27	5 31	5 36
	3	5 21	5 23	5 25	5 26	5 27	5 29	5 30	5 32	5 32	5 33	5 34	5 35	5 36
	4	6 13	6 09	6 05	6 00	5 58	5 55	5 51	5 47	5 45	5 43	5 41	5 39	5 36
	5	7 06	6 56	6 47	6 36	6 29	6 22	6 14	6 04	6 00	5 55	5 49	5 43	5 36
	6	8 01	7 47	7 32	7 15	7 05	6 54	6 41	6 25	6 17	6 09	6 00	5 50	5 38
	7	8 59	8 41	8 21	7 59	7 46	7 31	7 13	6 51	6 41	6 29	6 16	6 01	5 42
	8	10 00	9 39	9 16	8 49	8 34	8 16	7 55	7 27	7 14	6 59	6 41	6 20	5 53
	9	11 01	10 39	10 14	9 46	9 30	9 10	8 47	8 17	8 02	7 45	7 24	6 58	6 22
	10	12 01	11 39	11 15	10 47	10 31	10 13	9 50	9 20	9 06	8 49	8 28	8 03	7 28
	11	12 57	12 37	12 16	11 51	11 36	11 19	10 59	10 33	10 20	10 06	9 49	9 29	9 03
	12	13 48	13 32	13 14	12 53	12 41	12 27	12 10	11 50	11 40	11 28	11 16	11 01	10 43
	13	14 36	14 23	14 09	13 53	13 44	13 33	13 21	13 05	12 58	12 50	12 41	12 31	12 19
	14	15 19	15 10	15 01	14 50	14 44	14 37	14 28	14 18	14 14	14 09	14 03	13 56	13 49
	15	16 00	15 56	15 51	15 45	15 42	15 38	15 34	15 29	15 26	15 24	15 21	15 18	15 14
	16	16 40	16 39	16 39	16 39	16 38	16 38	16 38	16 38	16 37	16 37	16 37	16 37	16 37
	17	17 19	17 23	17 27	17 32	17 35	17 38	17 41	17 46	17 48	17 50	17 53	17 55	17 59
	18	17 59	18 07	18 16	18 26	18 31	18 37	18 45	18 54	18 59	19 03	19 09	19 15	19 21
	19	18 40	18 52	19 05	19 20	19 28	19 38	19 50	20 04	20 11	20 18	20 27	20 36	20 47
	20	19 24	19 40	19 57	20 16	20 27	20 40	20 56	21 15	21 25	21 35	21 47	22 00	22 16
	21	20 11	20 30	20 50	21 14	21 27	21 43	22 03	22 27	22 39	22 52	23 08	23 26	23 49
	22	21 00	21 22	21 45	22 11	22 27	22 45	23 07	23 36	23 50	...	...	...	...
	23	21 53	22 15	22 40	23 08	23 24	23 43	...	...	...	0 06	0 25	0 49	1 21
	24	22 47	23 09	23 33	...	...	...	0 07	0 37	0 53	1 10	1 32	1 59	2 38
	25	23 41	...	...	0 01	0 17	0 36	0 59	1 29	1 43	2 01	2 21	2 46	3 21
	26	...	0 02	0 24	0 49	1 04	1 21	1 42	2 08	2 21	2 36	2 53	3 13	3 38
	27	0 34	0 52	1 11	1 33	1 45	2 00	2 17	2 38	2 48	3 00	3 12	3 27	3 45
	28	1 26	1 40	1 55	2 12	2 21	2 32	2 45	3 01	3 08	3 16	3 25	3 36	3 47
	29	2 17	2 26	2 36	2 47	2 54	3 01	3 09	3 19	3 24	3 29	3 35	3 41	3 48
	30	3 07	3 11	3 16	3 21	3 24	3 27	3 31	3 35	3 37	3 40	3 42	3 45	3 48
Nov.	31	3 57	3 56	3 55	3 54	3 53	3 52	3 51	3 51	3 50	3 50	3 49	3 49	3 48
	1	4 48	4 42	4 35	4 28	4 23	4 19	4 13	4 06	4 03	4 00	3 57	3 52	3 48
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	4	7 43	7 22	7 01	6 36	6 22	6 05	5 45	5 20	5 08	4 55	4 39	4 21	3 59
	5	8 46	8 24	8 00	7 32	7 16	6 57	6 34	6 05	5 51	5 34	5 14	4 50	4 18
	6	9 49	9 27	9 03	8 34	8 18	7 59	7 35	7 05	6 50	6 32	6 11	5 45	5 08
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	10	13 18	13 08	12 57	12 44	12 37	12 29	12 19	12 08	12 02	11 56	11 49	11 42	11 33
	11	14 00	13 54	13 47	13 40	13 36	13 31	13 26	13 19	13 16	13 12	13 09	13 05	13 00
	12	14 40	14 38	14 36	14 34	14 33	14 31	14 30	14 28	14 27	14 26	14 25	14 24	14 23
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	15	16 39	16 50	17 01	17 14	17 22	17 30	17 41	17 53	17 59	18 06	18 13	18 21	18 30
	16	17 22	17 36	17 52	18 10	18 20	18 32	18 47	19 04	19 13	19 22	19 32	19 45	19 59
	17	18 08	18 26	18 45	19 07	19 20	19 35	19 53	20 16	20 27	20 39	20 54	21 11	21 31

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		^h _m	^h _m	^h _m	^h _m	^h _m	^h _m	^h _m	^h _m	^h _m	^h _m	^h _m	^h _m	^h _m
Oct.	1	16 03	15 54	15 44	15 32	15 26	15 18	15 09	14 58	14 53	14 47	14 41	14 33	14 25
	2	16 55	16 50	16 46	16 41	16 38	16 34	16 30	16 25	16 23	16 20	16 18	16 15	16 11
	3	17 46	17 47	17 48	17 49	17 50	17 51	17 52	17 53	17 54	17 55	17 55	17 56	17 57
	4	18 38	18 44	18 51	18 59	19 04	19 09	19 15	19 23	19 26	19 30	19 34	19 39	19 45
	5	19 32	19 43	19 56	20 11	20 19	20 29	20 40	20 54	21 01	21 08	21 16	21 25	21 36
	6	20 28	20 45	21 03	21 24	21 35	21 49	22 06	22 26	22 36	22 47	23 00	23 14	23 32
	7	21 28	21 48	22 10	22 36	22 50	23 07	23 28	23 54	.. ..	.. ..	.. ..	.. ..	.. ..
	8	22 30	22 52	23 16	23 44	.. ..	.. ..	.. ..	.. ..	0 07	0 22	0 39	1 00	1 26
	9	23 30	23 53	.. ..	.. ..	0 00	0 19	0 42	1 12	1 27	1 44	2 05	2 30	3 06
	10	.. ..	.. ..	0 17	0 45	1 01	1 21	1 44	2 14	2 28	2 45	3 06	3 31	4 06
	11	0 28	0 49	1 12	1 38	1 53	2 11	2 32	2 58	3 11	3 26	3 43	4 04	4 30
	12	1 22	1 41	2 00	2 23	2 35	2 50	3 08	3 30	3 40	3 52	4 05	4 20	4 39
	13	2 12	2 26	2 42	3 00	3 10	3 22	3 36	3 52	4 00	4 09	4 19	4 30	4 42
	14	2 57	3 08	3 19	3 32	3 39	3 48	3 58	4 09	4 15	4 21	4 27	4 35	4 43
	15	3 39	3 46	3 53	4 01	4 05	4 10	4 16	4 23	4 26	4 30	4 34	4 38	4 43
	16	4 19	4 22	4 24	4 27	4 29	4 31	4 33	4 35	4 36	4 38	4 39	4 41	4 42
	17	4 59	4 57	4 55	4 53	4 52	4 50	4 49	4 47	4 46	4 45	4 44	4 43	4 41
	18	5 38	5 32	5 26	5 19	5 15	5 10	5 05	4 58	4 56	4 52	4 49	4 45	4 40
	19	6 19	6 09	5 58	5 46	5 39	5 31	5 22	5 11	5 06	5 01	4 55	4 48	4 40
	20	7 01	6 47	6 32	6 16	6 06	5 55	5 42	5 26	5 19	5 11	5 02	4 52	4 40
	21	7 46	7 29	7 10	6 49	6 37	6 23	6 06	5 46	5 36	5 25	5 13	4 59	4 42
	22	8 34	8 14	7 53	7 27	7 13	6 56	6 36	6 11	5 59	5 45	5 29	5 10	4 46
	23	9 25	9 03	8 39	8 12	7 56	7 37	7 15	6 46	6 32	6 15	5 56	5 31	4 59
	24	10 19	9 56	9 31	9 03	8 47	8 27	8 03	7 33	7 18	7 00	6 39	6 11	5 32
	25	11 13	10 51	10 27	10 01	9 44	9 25	9 03	8 33	8 19	8 02	7 42	7 17	6 42
	26	12 07	11 47	11 26	11 02	10 48	10 31	10 11	9 46	9 33	9 19	9 03	8 43	8 18
	27	12 59	12 43	12 26	12 06	11 55	11 41	11 25	11 05	10 56	10 45	10 33	10 18	10 02
	28	13 51	13 39	13 26	13 12	13 03	12 54	12 42	12 28	12 21	12 14	12 06	11 57	11 46
	29	14 41	14 34	14 26	14 18	14 13	14 07	14 01	13 53	13 49	13 45	13 40	13 35	13 29
	30	15 30	15 29	15 27	15 25	15 23	15 22	15 20	15 18	15 17	15 16	15 15	15 14	15 12
Nov.	31	16 21	16 25	16 28	16 33	16 35	16 38	16 42	16 46	16 48	16 50	16 52	16 55	16 58
	1	17 14	17 23	17 33	17 44	17 50	17 57	18 06	18 16	18 21	18 27	18 33	18 39	18 47
	2	18 10	18 24	18 39	18 57	19 07	19 19	19 33	19 50	19 58	20 07	20 17	20 29	20 42
	3	19 10	19 29	19 48	20 12	20 25	20 41	21 00	21 23	21 34	21 47	22 03	22 20	22 42
	4	20 13	20 35	20 58	21 25	21 40	21 59	22 21	22 50	23 04	23 20	23 40	.. ..	.. ..
	5	21 17	21 39	22 04	22 32	22 48	23 08	23 31	.. ..	.. ..	.. ..	.. ..	0 04	0 36
	6	22 18	22 40	23 03	23 31	23 46	.. ..	.. ..	0 02	0 17	0 34	0 55	1 21	1 58
	7	23 16	23 35	23 56	.. ..	.. ..	0 05	0 27	0 55	1 09	1 24	1 43	2 06	2 36
	8	.. ..	.. ..	.. ..	0 20	0 33	0 49	1 08	1 32	1 43	1 56	2 11	2 28	2 49
	9	0 08	0 24	0 41	1 00	1 11	1 24	1 39	1 58	2 06	2 16	2 27	2 39	2 54
	10	0 55	1 07	1 20	1 35	1 43	1 52	2 03	2 17	2 23	2 30	2 37	2 46	2 56
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	14	3 38	3 33	3 28	3 23	3 19	3 16	3 12	3 07	3 05	3 02	3 00	2 57	2 53
	15	4 18	4 09	4 00	3 49	3 43	3 37	3 29	3 19	3 15	3 10	3 05	2 59	2 53
	16	4 59	4 47	4 33	4 18	4 09	3 59	3 48	3 34	3 27	3 20	3 12	3 03	2 53
	17	5 44	5 27	5 10	4 50	4 39	4 26	4 10	3 52	3 43	3 33	3 21	3 09	2 54

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Nov.	16	17 22	17 36	17 52	18 10	18 20	18 32	18 47	19 04	19 13	19 22	19 32	19 45	19 59
	17	18 08	18 26	18 45	19 07	19 20	19 35	19 53	20 16	20 27	20 39	20 54	21 11	21 31
	18	18 57	19 17	19 40	20 05	20 20	20 38	20 59	21 26	21 40	21 55	22 13	22 35	23 04
	19	19 49	20 11	20 35	21 02	21 19	21 38	22 01	22 31	22 46	23 03	23 24	23 51	...
	20	20 42	21 05	21 29	21 57	22 13	22 32	22 56	23 26	23 41	23 58	...	...	0 28
	21	21 36	21 57	22 20	22 47	23 02	23 20	23 41	...	...	...	0 19	0 45	1 22
	22	22 29	22 48	23 08	23 31	23 44	...	...	0 09	0 22	0 37	0 55	1 17	1 45
	23	23 20	23 36	23 52	...	...	0 00	0 18	0 41	0 52	1 04	1 18	1 34	1 54
	24	...	...	...	0 10	0 21	0 33	0 48	1 05	1 13	1 22	1 33	1 44	1 58
	25	0 09	0 21	0 32	0 46	0 53	1 02	1 12	1 24	1 30	1 36	1 43	1 50	1 59
	26	0 58	1 04	1 11	1 18	1 23	1 28	1 33	1 40	1 43	1 47	1 51	1 55	1 59
	27	1 45	1 47	1 48	1 50	1 51	1 52	1 53	1 55	1 56	1 56	1 57	1 58	1 59
	28	2 34	2 30	2 26	2 22	2 20	2 17	2 13	2 10	2 08	2 06	2 04	2 02	1 59
	29	3 25	3 16	3 07	2 57	2 50	2 44	2 36	2 26	2 22	2 17	2 12	2 06	2 00
	30	4 21	4 07	3 52	3 35	3 26	3 15	3 02	2 47	2 39	2 31	2 22	2 13	2 01
Dec.	1	5 20	5 02	4 42	4 20	4 07	3 53	3 35	3 13	3 03	2 52	2 39	2 24	2 06
	2	6 24	6 02	5 39	5 13	4 58	4 40	4 18	3 51	3 38	3 23	3 06	2 45	2 18
	3	7 29	7 06	6 42	6 14	5 57	5 38	5 14	4 45	4 30	4 12	3 52	3 26	2 51
	4	8 32	8 11	7 47	7 20	7 04	6 45	6 22	5 54	5 39	5 22	5 03	4 38	4 05
	5	9 31	9 12	8 51	8 27	8 13	7 57	7 37	7 12	7 00	6 47	6 31	6 11	5 48
	6	10 25	10 09	9 52	9 32	9 21	9 08	8 53	8 33	8 24	8 14	8 02	7 49	7 33
	7	11 13	11 01	10 49	10 34	10 26	10 16	10 05	9 52	9 45	9 38	9 30	9 21	9 11
	8	11 57	11 49	11 41	11 32	11 27	11 21	11 14	11 06	11 02	10 58	10 53	10 47	10 41
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	16	17 43	18 05	18 29	18 56	19 12	19 30	19 53	20 22	20 37	20 54	21 14	21 39	22 13
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	18	19 32	19 53	20 17	20 44	20 59	21 18	21 40	22 08	22 22	22 38	22 57	23 20	23 50
	19	20 25	20 45	21 06	21 30	21 44	22 00	22 19	22 43	22 55	23 08	23 23	23 41	...
	20	21 17	21 34	21 51	22 11	22 22	22 35	22 51	23 10	23 19	23 28	23 40	23 53	0 03
	21	22 07	22 19	22 32	22 47	22 55	23 05	23 16	23 30	23 36	23 43	23 51	...	0 08
	22	22 54	23 02	23 10	23 20	23 25	23 31	23 38	23 46	23 50	23 55	23 59	0 00	0 09
	23	23 41	23 44	23 47	23 51	23 53	23 55	23 58	...	...	...	...	0 04	0 10
	24	...	...	...	...	...	...	...	0 01	0 02	0 04	0 06	0 08	0 10
	25	0 28	0 26	0 24	0 21	0 20	0 19	0 17	0 15	0 14	0 13	0 12	0 11	0 10
	26	1 16	1 09	1 02	0 53	0 49	0 44	0 37	0 30	0 27	0 23	0 19	0 15	0 10
	27	2 07	1 55	1 43	1 29	1 21	1 11	1 01	0 48	0 42	0 35	0 28	0 20	0 11
	28	3 03	2 46	2 29	2 09	1 58	1 45	1 29	1 11	1 02	0 52	0 41	0 28	0 14
	29	4 03	3 43	3 21	2 57	2 43	2 26	2 07	1 42	1 30	1 17	1 02	0 43	0 21
	30	5 07	4 44	4 20	3 53	3 37	3 18	2 56	2 27	2 12	1 56	1 37	1 13	0 41
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	32	7 13	6 53	6 30	6 05	5 50	5 32	5 10	4 43	4 30	4 15	3 57	3 35	3 07

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Nov.	16	4 59	4 47	4 33	4 18	4 09	3 59	3 48	3 34	3 27	3 20	3 12	3 03	2 53
	17	5 44	5 27	5 10	4 50	4 39	4 26	4 10	3 52	3 43	3 33	3 21	3 09	2 54
	18	6 31	6 12	5 51	5 27	5 14	4 58	4 39	4 15	4 04	3 51	3 36	3 18	2 58
	19	7 21	7 00	6 37	6 10	5 55	5 36	5 14	4 47	4 33	4 17	3 59	3 36	3 07
	20	8 14	7 52	7 27	7 00	6 43	6 23	6 00	5 30	5 15	4 58	4 36	4 10	3 33
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	22	10 02	9 41	9 19	8 54	8 39	8 22	8 01	7 34	7 21	7 06	6 49	6 27	6 00
	23	10 54	10 36	10 18	9 57	9 44	9 29	9 12	8 50	8 40	8 28	8 14	7 59	7 40
	24	11 44	11 31	11 16	11 00	10 50	10 39	10 26	10 10	10 02	9 54	9 44	9 33	9 21
	25	12 32	12 24	12 14	12 03	11 57	11 50	11 41	11 31	11 26	11 21	11 15	11 08	11 01
	26	13 20	13 16	13 12	13 07	13 04	13 01	12 57	12 53	12 50	12 48	12 45	12 43	12 39
	27	14 08	14 09	14 10	14 12	14 13	14 13	14 14	14 16	14 16	14 17	14 17	14 18	14 19
	28	14 58	15 04	15 11	15 19	15 23	15 28	15 34	15 41	15 45	15 48	15 53	15 57	16 02
	29	15 51	16 02	16 15	16 29	16 37	16 47	16 58	17 11	17 17	17 24	17 32	17 41	17 52
	30	16 48	17 05	17 22	17 43	17 54	18 08	18 24	18 44	18 54	19 04	19 17	19 31	19 48
Dec.	1	17 50	18 10	18 32	18 57	19 11	19 29	19 49	20 15	20 28	20 43	21 00	21 21	21 47
	2	18 55	19 17	19 41	20 09	20 25	20 44	21 08	21 37	21 52	22 09	22 30	22 55	23 31
	3	20 00	20 22	20 46	21 14	21 30	21 49	22 12	22 42	22 56	23 13	23 33	23 58	...
	4	21 01	21 22	21 44	22 09	22 24	22 41	23 02	23 27	23 40	23 54	0 31
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	6	22 48	23 02	23 17	23 33	23 42	23 53	0 08	0 19	0 32	0 46	1 03
	7	23 34	23 44	23 54	0 06	0 21	0 28	0 36	0 44	0 54	1 06
	8	...	...	...	0 05	0 11	0 19	0 27	0 37	0 42	0 47	0 53	0 59	1 07
	9	0 17	0 22	0 27	0 34	0 37	0 41	0 46	0 51	0 54	0 56	0 59	1 03	1 06
	10	0 57	0 58	0 59	1 00	1 01	1 01	1 02	1 03	1 04	1 04	1 05	1 05	1 06
	11	1 36	1 33	1 29	1 26	1 23	1 21	1 18	1 14	1 13	1 11	1 09	1 07	1 05
	12	2 16	2 08	2 01	1 52	1 47	1 41	1 34	1 27	1 23	1 19	1 15	1 10	1 04
	13	2 57	2 45	2 33	2 20	2 12	2 03	1 53	1 40	1 34	1 28	1 21	1 13	1 04
	14	3 40	3 25	3 09	2 51	2 40	2 28	2 14	1 57	1 49	1 40	1 30	1 18	1 05
	15	4 26	4 08	3 49	3 26	3 13	2 58	2 40	2 18	2 08	1 56	1 42	1 27	1 08
	16	5 16	4 55	4 33	4 07	3 52	3 35	3 14	2 47	2 34	2 20	2 02	1 42	1 15
	17	6 09	5 47	5 23	4 55	4 39	4 20	3 57	3 27	3 12	2 55	2 35	2 10	1 35
	18	7 03	6 41	6 17	5 49	5 33	5 13	4 50	4 20	4 05	3 48	3 26	3 00	2 23
	19	7 58	7 37	7 14	6 48	6 33	6 15	5 53	5 25	5 12	4 56	4 38	4 15	3 45
	20	8 51	8 32	8 13	7 50	7 37	7 22	7 03	6 40	6 29	6 16	6 02	5 45	5 23
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	22	10 30	10 20	10 09	9 56	9 49	9 41	9 31	9 19	9 13	9 07	9 01	8 53	8 44
	23	11 17	11 11	11 05	10 59	10 55	10 50	10 45	10 39	10 36	10 33	10 29	10 25	10 21
	24	12 03	12 02	12 02	12 01	12 01	12 00	12 00	11 59	11 59	11 58	11 58	11 57	11 57
	25	12 50	12 55	12 59	13 05	13 08	13 11	13 15	13 20	13 23	13 25	13 28	13 31	13 35
	26	13 40	13 49	13 59	14 11	14 17	14 25	14 34	14 45	14 50	14 56	15 02	15 09	15 17
	27	14 33	14 47	15 02	15 20	15 30	15 42	15 56	16 13	16 21	16 30	16 41	16 52	17 06
	28	15 31	15 49	16 09	16 32	16 45	17 01	17 20	17 43	17 54	18 07	18 22	18 40	19 01
	29	16 33	16 54	17 18	17 45	18 00	18 18	18 40	19 09	19 23	19 39	19 58	20 21	20 53
	30	17 38	18 00	18 25	18 53	19 09	19 28	19 52	20 22	20 37	20 54	21 14	21 40	22 16
	31	18 41	19 03	19 27	19 53	20 09	20 27	20 49	21 17	21 30	21 46	22 04	22 26	22 55
	32	19 41	20 00	20 21	20 44	20 58	21 13	21 32	21 55	22 06	22 18	22 32	22 49	23 09

Place	Description	Altitude	Longitude
		m	h m s
Aarhus, Denmark	Ole Römer Observatory	50	-0 40 47.3 b
Abastuman, Georgian S. S. R. . .	Astrophysical Obs. of Acad. of Sciences	1580	-2 51 18.08 b
Abbadia, France	Obs. of Paris Acad. of Sci., Hendaye	69	+0 07 00.1 c
Albany, New York	Dudley Observatory	70	+4 55 07.12 c
Algiers, Algeria	Algiers Observatory, at Bouzaréah	345	-0 12 08.53 c
Alma-Ata, Kazak S. S. R. . . .	Mountain Obs. of Academy of Sciences	1450	-5 07 49.76
Amherst, Massachusetts	Amherst College Observatory	110	+4 50 05.93 a
Amsterdam, Netherlands	Tilanus Observatory	30	-0 19 38.81
Ann Arbor, Michigan	Observatory of University of Michigan	282	+5 34 55.27 c
Appleton, Wisconsin	Underwood Obs., Lawrence College	242	+5 53 35.92 a
Arcetri (Florence), Italy	Astrophysical Observatory	184	-0 45 01.30 a
Armagh, Northern Ireland	Armagh Observatory	64	+0 26 35.48 b
Ashkhabad, Turkmen S. S. R. . .	Astrophysical Lab. of Acad. of Sciences	234	-3 53 24.6 b
Asiago (Vicenza), Italy	Astrophysical Obs. of Padua Univ.	1045	-0 46 06.86 b
Athens, Greece	National Observatory	110	-1 34 52.06 c
Baguio City, Philippines	Manila Observatory	1507	-8 02 19.1
Bamberg, Germany	Remeis Observatory	288	-0 43 33.57 c
Barcelona, Spain	Fabra Observatory	415	-0 08 30.2
Basel-Binningen, Switzerland . .	Astron.-Meteorol. Inst., Univ. Basel	318	-0 30 20.02
Baton Rouge, Louisiana	Observatory of University of Louisiana	31	+6 04 42.96
Beirut, Lebanon	American University Observatory	38	-2 21 52.7 a
Belgrade, Yugoslavia	Observatory of Academy of Sciences	253	-1 22 03.20
Beloit, Wisconsin	Smith Observatory, Beloit College	—	+5 56 07.4
Berkeley, California	Leuschner Observatory, Univ. of Calif.	94	+8 09 02.91
Berlin, Germany	Wilhelm Foerster Institute	40	-0 53 42
Berlin-Babelsberg, Germany . . .	Observatory of Academy of Sciences	82	-0 52 25.49 a
Berlin-Treptow, Germany	Archenhold Observatory	38	-0 53 54.2
Berne, Switzerland	Astronomical Institute of the Univ.	563	-0 29 42.88
Besançon, France	National Observatory	312	-0 23 57.42 c
Bethany, Connecticut	Yale University Observatory	213	+4 51 56.3
Beverwijk, Netherlands	Observatory of B. J. Vastenholt	3	-0 18 35.30 b
Billingshurst, Sussex	Observatory of W. B. Caunter	61	+0 02 19.0 a
Blaca, Yugoslavia	Observatory of N. Miličević	223	-1 06 08.0
Blaricum, Netherlands	Observatory of L. J. de Lange	4	-0 20 59.5 b
Bloemfontein, South Africa . . .	Boyden Station, at Mazelspoort	1387	-1 45 37.4 b
Bloemfontein, South Africa . . .	Lamont-Hussey Obs., br. of Obs. U. of Mich.	1490	-1 44 57
Bloomington, Indiana	Kirkwood Obs., University of Indiana	238	+5 46 05 c
Bogotá, Colombia	National Observatory	2640	+4 56 19.51
Bologna, Italy	University Observatory	84	-0 45 24.48
Bombay (Colaba), India	Government Observatory	14	-4 51 15.72 c
Bonn, Germany	University Observatory	62	-0 28 23.18
Bordeaux, France	Obs. of Univ. of Bordeaux, at Floirac	73	+0 02 06.60 c
Borowiec, Poland	Latitude Station of Academy of Sciences	80	-1 08 18.45
Bosque Alegre, Argentina	Branch of National Observatory	1250	+4 18 11.2 b
Boston, Massachusetts	Boston University Observatory	32	+4 44 25.5 a

a Equatorial refractor

b Equatorial reflector

c Transit or meridian circle

d Zenith telescope

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δx_s	ΔZ
h m	s	° '	° ' "					
0 40.8	- 6.70	- 10 11.8	+56 07 40	+0.82663	0.55864	+1.47970	-238	-353
2 51.3	-28.14	- 42 49.5	+41 45 18.2	+0.66262	0.74730	+0.88669	-319	-283
23 53.0	+ 1.15	+ 1 45.0	+43 22 52.2	+0.68332	0.72796	+0.93868	-311	-292
19 04.9	+48.48	+ 73 46.8	+42 39 12.8	+0.67406	0.73661	+0.91508	-314	-288
0 12.1	- 1.99	- 3 02.1	+36 48 04.8	+0.59577	0.80173	+0.74310	-342	-254
5 07.8	-50.57	- 76 57.4	+43 11 16.9	+0.68102	0.73043	+0.93236	-312	-290
19 09.9	+47.66	+ 72 31.5	+42 21 56.5	+0.67037	0.74000	+0.90590	-316	-286
0 19.6	- 3.23	- 4 54.7	+52 22 18.3	+0.78833	0.61183	+1.28849	-261	-336
18 25.1	+55.02	+ 83 43.8	+42 16 48.7	+0.66928	0.74102	+0.90319	-316	-286
18 06.4	+58.09	+ 88 24.0	+44 15 39.2	+0.69440	0.71737	+0.96798	-306	-296
0 45.0	- 7.40	- 11 15.3	+43 45 14.4	+0.68804	0.72350	+0.95099	-309	-294
23 33.4	+ 4.37	+ 6 38.9	+54 21 11.1	+0.80897	0.58409	+1.38500	-249	-345
3 53.4	-38.34	- 58 21.2	+37 57 24	+0.61173	0.78951	+0.77482	-337	-261
0 46.1	- 7.58	- 11 31.7	+45 51 44.7	+0.71420	0.69771	+1.02364	-298	-305
1 34.9	-15.58	- 23 43.0	+37 58 19.7	+0.61193	0.78933	+0.77526	-337	-261
8 02.3	-79.23	-120 34.8	+16 24 39	+0.28077	0.95974	+0.29254	-409	-120
0 43.6	- 7.16	- 10 53.4	+49 53 06.4	+0.76114	0.64562	+1.17893	-275	-325
0 08.5	- 1.40	- 2 07.6	+41 24 59.3	+0.65809	0.75108	+0.87620	-320	-281
0 30.3	- 4.98	- 7 35.0	+47 32 27.2	+0.73418	0.67634	+1.08552	-289	-313
17 55.3	+59.91	+ 91 10.7	+30 24 44.1	+0.50325	0.86315	+0.58304	-368	-215
2 21.9	-23.31	- 35 28.2	+33 54 22	+0.55467	0.83083	+0.66761	-354	-237
1 22.1	-13.48	- 20 30.8	+44 48 13.2	+0.70114	0.71074	+0.98649	-303	-299
18 03.9	+58.50	+ 89 01.9	+42 30 08.4	+0.67211	0.73838	+0.91025	-315	-287
15 51.0	+80.34	+122 15.7	+37 52 23.5	+0.61057	0.79039	+0.77250	-337	-260
0 53.7	- 8.82	- 13 25.5	+52 28 30	+0.78943	0.61040	+1.29330	-260	-337
0 52.4	- 8.61	- 13 06.4	+52 24 24.2	+0.78871	0.61135	+1.29011	-261	-336
0 53.9	- 8.86	- 13 28.6	+52 29 07	+0.78954	0.61026	+1.29378	-260	-337
0 29.7	- 4.88	- 7 25.7	+46 57 12.7	+0.72726	0.68388	+1.06343	-292	-310
0 24.0	- 3.94	- 5 59.4	+47 14 59.8	+0.73075	0.68007	+1.07452	-290	-312
19 08.1	+47.96	+ 72 59.1	+41 25 37	+0.65821	0.75093	+0.87652	-320	-281
0 18.6	- 3.05	- 4 38.8	+52 29 09.0	+0.78954	0.61025	+1.29380	-260	-337
23 57.7	+ 0.38	+ 0 34.7	+51 04 51.7	+0.77439	0.62951	+1.23015	-269	-330
1 06.1	-10.86	- 16 32.0	+43 17 32.3	+0.68221	0.72904	+0.93577	-311	-291
0 21.0	- 3.45	- 5 14.9	+52 16 15.2	+0.78725	0.61322	+1.28380	-262	-336
1 45.6	-17.35	- 26 24.3	-29 02 18	-0.48262	0.87518	-0.55145	-373	+206
1 44.9	-17.24	- 26 14.3	-29 05 45	-0.48350	0.87471	-0.55276	-373	+206
18 13.9	+56.85	+ 86 31.3	+39 09 56	+0.62818	0.77640	+0.80910	-331	-268
19 03.7	+48.68	+ 74 04.9	+ 4 35 55.2	+0.07967	0.99722	+0.07989	-425	- 34
0 45.4	- 7.46	- 11 21.1	+44 29 52.8	+0.69733	0.71446	+0.97602	-305	-298
4 51.3	-47.85	- 72 48.9	+18 53 36.2	+0.32174	0.94646	+0.33995	-404	-137
0 28.4	- 4.66	- 7 05.8	+50 43 45.0	+0.77052	0.63427	+1.21481	-271	-329
23 57.9	+ 0.35	+ 0 31.6	+44 50 07	+0.70151	0.71033	+0.98758	-303	-299
1 08.3	-11.22	- 17 04.6	+52 16 38.0	+0.78733	0.61314	+1.28409	-262	-336
19 41.8	+42.41	+ 64 32.8	-31 35 53	-0.52102	0.85270	-0.61102	-364	+222
19 15.6	+46.72	+ 71 06.4	+42 21 00.6	+0.67016	0.74018	+0.90540	-316	-286

If the horizontal parallax, $\pi=8''.80/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha = \frac{1}{15} \pi \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h = \theta - \alpha$ and θ = sidereal time at 0^h + sidereal equivalent of U.T. - λ

Otherwise add $\Delta X = \Delta x_s \cos \theta$, $\Delta Y = \Delta x_s \sin \theta$, ΔZ to solar coordinates to eliminate parallax.

Place	Description	Altitude	Longitude		
		m	h	m	s
Boulder, Colorado	Sommers-Bausch Observatory	1648	+	7 01	02.93
Brno, Czechoslovakia	Astro. Inst. of the Polytechnic School	277	-	1 06	22.3
Brno, Czechoslovakia	Masaryk University Observatory	310	-	1 06	21.10
Brooklyn, Indiana	Goethe Link Obs., Univ. of Indiana	300	+	5 45	34.86 b
Brunswick, Maine	Bowdoin College Observatory	25	+	4 39	51.3 b
Bucharest, Romania	National Observatory	83	-	1 44	23.20
Budapest, Hungary	Konkoly Observatory	474	-	1 15	51.41 c
Buenos Aires, Argentina	Naval Observatory	6	+	3 53	25.22 c
Burakan, Armenian S. S. R.	Astronomical Obs. of Acad. of Sciences	1500	-	2 57	10
Bussum, Netherlands	Observatory of D. Schmidt	10	-	0 20	41.6
Cambridge, England	University Observatories	28	-	0 00	22.75 c
Cambridge, Massachusetts	Harvard College Observatory	24	+	4 44	31.05
Canberra, Australia	Mount Stromlo Observatory	768	-	9 56	01.35 c
Cape of Good Hope, S. Africa	Royal Observatory	10	-	1 13	54 38 c
Caracas, Venezuela	Cajigal Observatory	1042	+	4 27	42.61
Carloforte, Sardinia	International Latitude Observatory	18	-	0 33	14.9 d
Castel Gandolfo, Italy	Vatican Observatory	450	-	0 50	36.33
Catania, Sicily	Astrophysical Observatory	47	-	1 00	20.60
Charlottesville, Virginia	Leander McCormick Obs., Univ. of Va.	259	+	5 14	05.33 a
Cincinnati, Ohio	Cincinnati Observatory	247	+	5 37	41.40 a
Claremont, California	F. P. Brackett Obs., Pomona College	368	+	7 50	50.68 c
Cleveland, Ohio	Warner and Swasey Observatory	247	+	5 26	16.36 c
Climax, Colorado	High Altitude Observatory	3394	+	7 04	50.27
Coimbra, Portugal	University Observatory	99	+	0 33	43.10 c
Columbia, South Carolina	Melton Memorial Obs., Univ. of S. C.	98	+	5 24	06.20 a
Columbus, Ohio	McMillin Observatory, State University	233	+	5 32	02.60 c
Coonabarabran, New South Wales	Field Station of Mount Stromlo Observatory	1164	-	9 54	44
Copenhagen, Denmark	University Observatory	14	-	0 50	18.69 a
Copenhagen, Denmark	Urania Observatory	10	-	0 50	09.11 a
Copenhagen, Denmark	Observatory of P. Darnell	—	-	0 49	48.67
Cordoba, Argentina	National Observatory	434	+	4 16	47.16
Cracow, Poland	University Observatory	221	-	1 19	50.3 a
Danzig, Danzig	Municipal Observatory	31	-	1 14	36.5
Decatur, Georgia	Bradley Obs., Agnes Scott College	315	+	5 37	10.60 b
Dehra Dun, India	Haig Obs., Trig. Survey of India	682	-	5 12	11.79
Delaware, Ohio	Perkins Obs., Ohio Wesleyan University	270	+	5 32	13.33
Denver, Colorado	Chamberlin Obs., Univ. of Denver	1644	+	6 59	47.72 a
Des Moines, Iowa	Drake University Municipal Obs.	291	+	6 14	44.7 c
Dublin, Ireland	Dunsink Observatory	86	+	0 25	21.1 c
Dunedin, New Zealand	Beverly-Begg Observatory	141	-	11 21	58.05 b
Dushanbe, Tadjik S. S. R.	Astronomical Obs. of Acad. of Sciences	820	-	4 35	07.47
Eddleston, Scotland	Earlyburn Outstation ¹	282	+	0 12	54.80
Edinburgh, Scotland	Royal Observatory	146	+	0 12	43.8 b
Evanston, Illinois	Dearborn Obs., Northwestern Univ.	175	+	5 50	41.84 c
Faenza, Italy	Urania Lamonia Observatory	51	-	0 47	30.9

a Equatorial refractor

b Equatorial reflector

c Transit or meridian circle

d Zenith telescope

¹ Outstation of the Royal Observatory Edinburgh

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δx_p	ΔZ
h m	s	° '	° ' "					
16 59.0	+ 69.17	+105 15.7	+40 00 13	+0.63957	0.76727	+0.83357	-327	-273
1 06.4	- 10.90	- 16 35.6	+49 12 24	+0.75347	0.65462	+1.15099	-279	-321
1 06.4	- 10.90	- 16 35.3	+49 12 15.1	+0.75344	0.65466	+1.15089	-279	-321
18 14.4	+ 56.77	+ 86 23.7	+39 32 57.7	+0.63336	0.77217	+0.82023	-329	-270
19 20.1	+ 45.97	+ 69 57.8	+43 54 33.2	+0.68997	0.72161	+0.95616	-308	-294
1 44.4	- 17.15	- 26 05.8	+44 24 49.4	+0.69629	0.71549	+0.97315	-305	-297
1 15.9	- 12.46	- 18 57.9	+47 29 58.6	+0.73371	0.67688	+1.08396	-289	-313
20 06.6	+ 38.34	+ 58 21.3	-34 37 18.3	-0.56495	0.82382	-0.68577	-351	+241
2 57.2	- 29.10	- 44 17.5	+40 20 07	+0.64397	0.76352	+0.84341	-326	-275
0 20.7	- 3.40	- 5 10.4	+52 16 34.2	+0.78731	0.61315	+1.28405	-262	-336
0 00.4	- 0.06	- 0 05.7	+52 12 51.6	+0.78665	0.61400	+1.28119	-262	-336
19 15.5	+ 46.74	+ 71 07.8	+42 22 47.6	+0.67054	0.73983	+0.90635	-316	-286
9 56.0	- 97.91	-149 00.3	-35 19 16	-0.57499	0.81694	-0.70383	-349	+245
1 13.9	- 12.14	- 18 28.6	-33 56 02.5	-0.55507	0.83055	-0.66831	-354	+237
19 32.3	+ 43.98	+ 66 55.7	+10 30 24.3	+0.18118	0.98350	+0.18421	-420	- 77
0 33.2	- 5.46	- 8 18.7	+39 08 08.9	+0.62776	0.77670	+0.80825	-331	-268
0 50.6	- 8.31	- 12 39.1	+41 44 47.4	+0.66239	0.74726	+0.88642	-319	-283
1 00.3	- 9.91	- 15 05.1	+37 30 13.3	+0.60548	0.79431	+0.76227	-339	-258
18 45.9	+ 51.60	+ 78 31.3	+38 02 01.2	+0.61279	0.78869	+0.77697	-336	-261
18 22.3	+ 55.47	+ 84 25.3	+39 08 19.8	+0.62782	0.77669	+0.80833	-331	-268
16 09.2	+ 77.35	+117 42.7	+34 05 34.0	+0.55739	0.82905	+0.67232	-354	-238
18 33.7	+ 53.60	+ 81 34.1	+41 32 13.1	+0.65965	0.74967	+0.87992	-320	-281
16 55.2	+ 69.79	+106 12.6	+39 23 29	+0.63154	0.77429	+0.81564	-330	-269
23 26.3	+ 5.54	+ 8 25.8	+40 12 24.5	+0.64212	0.76480	+0.83959	-326	-274
18 35.9	+ 53.24	+ 81 01.6	+33 59 46.7	+0.55597	0.82996	+0.66988	-354	-237
18 28.0	+ 54.55	+ 83 00.7	+39 59 50.4	+0.63934	0.76717	+0.83338	-327	-273
9 54.7	- 97.70	-148 41	-31 16	-0.51610	0.85569	-0.60313	-365	+220
0 50.3	- 8.26	- 12 34.7	+55 41 12.6	+0.82231	0.56501	+1.45537	-241	-351
0 50.2	- 8.24	- 12 32.3	+55 41 19.2	+0.82232	0.56499	+1.45547	-241	-351
0 49.8	- 8.18	- 12 27.2	+55 42 13	+0.82247	0.56477	+1.45629	-241	-351
19 43.2	+ 42.18	+ 64 11.8	-31 25 16.4	-0.51833	0.85420	-0.60680	-364	+221
1 19.8	- 13.12	- 19 57.6	+50 03 52.0	+0.76315	0.64322	+1.18645	-274	-326
1 14.6	- 12.26	- 18 39.1	+54 21 37.9	+0.80904	0.58398	+1.38538	-249	-345
18 22.8	+ 55.39	+ 84 17.7	+33 55 54.5	+0.55506	0.83061	+0.66825	-354	-237
5 12.2	- 51.29	- 78 02.9	+30 18 51.8	+0.50184	0.86410	+0.58076	-369	-214
18 27.8	+ 54.58	+ 83 03.3	+40 15 04	+0.64273	0.76433	+0.84090	-326	-274
17 00.2	+ 68.96	+104 56.9	+39 40 36.4	+0.63520	0.77091	+0.82396	-329	-271
17 45.3	+ 61.56	+ 93 41.2	+41 35 40	+0.66040	0.74901	+0.88170	-320	-282
23 34.6	+ 4.16	+ 6 20.3	+53 23 13.1	+0.79903	0.59771	+1.33681	-255	-341
11 22.0	-112.03	-170 29.5	-45 52 25.9	-0.71424	0.69746	-1.02405	-298	+305
4 35.1	- 45.20	- 68 46.9	+38 33 39.9	+0.62005	0.78307	+0.79182	-334	-265
23 47.1	+ 2.12	+ 3 13.7	+55 44 00.4	+0.82280	0.56436	+1.45792	-241	-351
23 47.3	+ 2.09	+ 3 11.0	+55 55 30.0	+0.82466	0.56159	+1.46844	-240	-352
18 09.3	+ 57.61	+ 87 40.5	+42 03 27.2	+0.66640	0.74361	+0.89616	-317	-284
0 47.5	- 7.81	- 11 52.7	+44 17 14	+0.69471	0.71703	+0.96886	-306	-296

If the horizontal parallax, $\pi=8''.80/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha = \pi \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h = \theta - \alpha$ and $\theta = \text{sidereal time at } 0^{\text{h}} + \text{sidereal equivalent of U.T.} - \lambda$

Otherwise add $\Delta X = \Delta x_p \cos \theta$, $\Delta Y = \Delta x_p \sin \theta$, ΔZ to solar coordinates to eliminate parallax.

Place	Description	Altitude	Longitude
		m	h m s
Fayette, Missouri	Morrison Observatory	232	+6 10 48.00
Flagstaff, Arizona	Branch of United States Naval Obs.	2310	+7 27 02.1 b
Flagstaff, Arizona	Lowell Observatory	2210	+7 26 44.6 a
Fort Davis, Texas	McDonald Obs., University of Texas	2081	+6 56 05.34
Fredericton, New Brunswick	Obs. of the Univ. of New Brunswick	40	+4 26 34
Gaithersburg, Maryland	International Latitude Observatory	155	+5 08 47.8 d
Geneva, New York	Smith Observatory	152	+5 08 01.00
Geneva, Switzerland	Municipal Observatory	407	-0 24 36.61 c
Genoa, Italy	Hydrographic Institute	105	-0 35 41.28 c
Gorki, R. S. F. S. R.	Latitude Station	163	-2 55 56
Göttingen, Germany	University Observatory	161	-0 39 46.22
Graz, Austria	Observatory of the University of Graz	375	-1 01 47.71 c
Greencastle, Indiana	McKim Obs., De Pauw University	262	+5 47 24.36 c
Groningen, Netherlands	Kapteyn Astronomical Laboratory	4	-0 26 15.11
Haarlem, Netherlands	Observatory of B. J. M. Walker	0	-0 18 35.47
Hamburg, Germany	German Hydrographic Institute	30	-0 39 53.44 c
Hamburg, Germany	Hamburg Observatory, at Bergedorf	41	-0 40 57.74 c
Hanover, Germany	Geodetic Institute	50	-0 38 51.3
Hanover, Germany	Obs. of Hanover Astronomical Society	50	-0 39 00.8
Hanover, New Hampshire	Shattuck Obs., Dartmouth College	183	+4 49 08.02
Hardenberg, Netherlands	Observatory of D. G. H. Kenskamp	15	-0 26 28.23 a
Harderwijk, Netherlands	Observatory of J. van Raalten	2	-0 22 29.9 b
Harestua, Norway	Observatory of the University of Oslo	585	-0 43 02
Hartbeespoort, South Africa	Republic Observatory Annexe	1220	-1 51 30.44 a
Harvard, Massachusetts	George R. Agassiz Sta. of Harvard Obs.	183	+4 46 14.2
Haverford, Pennsylvania	Strawbridge Mem. Obs., Haverford Coll.	116	+5 01 12.70 d
Heidelberg, Germany	State Observatory, at Königstuhl	570	-0 34 53.19 c
Helsingør, Denmark	Observatory of R. Fr. Rasmussen	—	-0 50 25.6
Helsinki, Finland	University Observatory	33	-1 39 49.10 c
Helsinki, Finland	Ursa Observatory	25	-1 39 50.09
Helsinki, Finland	Observatory of Institute of Technology	38	-1 39 44.30
Helwan, Egypt	Helwan Observatory	115	-2 05 21.87
Herstmonceux, Sussex	Royal Greenwich Observatory	34	-0 01 21.03 c
Hoher List, Germany	Hoher List Obs. of Bonn University	541	-0 27 23.9
Hoorn, Netherlands	Observatory of J. C. van der Meulen	—	-0 20 12.90 b
Hyderabad, India	Nizamiah Observatory	554	-5 13 48.98
Innsbruck, Austria	University Observatory	614	-0 45 31.4
Iowa City, Iowa	Observatory, University of Iowa	221	+6 06 08
Irkutsk, R. S. F. S. R.	Astronomical Obs. of State University	468	-6 57 22.71 c
Irkutsk, R. S. F. S. R.	City Astronomical Observatory	432	-6 57 07.1
Istanbul, Turkey	University Observatory	65	-1 55 52
Ithaca, New York	Fuertes Obs. of Cornell University	270	+5 05 54.3 a
Jakarta, Indonesia	International Latitude Observatory	23	-7 07 32 d
Jena, Germany	Karl Schwarzschild Obs. of Acad. of Sciences	331	-0 46 51
Jena, Germany	University Observatory	164	-0 46 20.22 a

a Equatorial refractor

b Equatorial reflector

c Transit or meridian circle

d Zenith telescope

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δ_{α}	ΔZ
h m	s	° '	° ' "					
17 49.2	+60.91	+ 92 42.0	+39 09 00.0	+0.62797	0.77657	+0.80865	-331	-268
16 33.0	+73.44	+111 45.5	+35 11 28	+0.57328	0.81844	+0.70045	-349	-244
16 33.3	+73.39	+111 41.1	+35 12 30.5	+0.57352	0.81826	+0.70090	-349	-245
17 03.9	+68.35	+104 01.3	+30 40 17.7	+0.50730	0.86114	+0.58910	-367	-216
19 33.4	+43.79	+ 66 38.5	+45 57.0	+0.71515	0.69650	+1.02677	-297	-305
18 51.2	+50.73	+ 77 11.9	+39 08 13.2	+0.62779	0.77670	+0.80828	-331	-268
18 52.0	+50.60	+ 77 00.3	+42 52 46.2	+0.67696	0.73395	+0.92235	-313	-289
0 24.6	- 4.04	- 6 09.2	+46 11 59.3	+0.71821	0.69340	+1.03577	-296	-306
0 35.7	- 5.86	- 8 55.3	+44 25 09.3	+0.69636	0.71542	+0.97334	-305	-297
2 55.9	-28.90	- 43 59.0	+56 15 32	+0.82791	0.55675	+1.48704	-238	-353
0 39.8	- 6.53	- 9 56.6	+51 31 48.2	+0.77930	0.62341	+1.25007	-266	-332
1 01.8	-10.15	- 15 26.9	+47 04 38.2	+0.72871	0.68228	+1.06804	-291	-311
18 12.6	+57.07	+ 86 51.1	+39 38 46.6	+0.63465	0.77109	+0.82306	-329	-271
0 26.3	- 4.31	- 6 33.8	+53 13 13.8	+0.79728	0.60003	+1.32873	-256	-340
0 18.6	- 3.05	- 4 38.9	+52 23 59.4	+0.78863	0.61144	+1.28979	-261	-336
0 39.9	- 6.55	- 9 58.4	+53 32 51.2	+0.80069	0.59546	+1.34467	-254	-342
0 41.0	- 6.73	- 10 14.4	+53 28 46.9	+0.79999	0.59641	+1.34134	-254	-341
0 38.9	- 6.38	- 9 42.8	+52 23 13	+0.78850	0.61162	+1.28919	-261	-336
0 39.0	- 6.41	- 9 45.2	+52 24 36	+0.78874	0.61130	+1.29026	-261	-337
19 10.9	+47.50	+ 72 17.0	+43 42 15.3	+0.68742	0.72410	+0.94934	-309	-293
0 26.5	- 4.35	- 6 37.1	+52 34 24.1	+0.79047	0.60904	+1.29790	-260	-337
0 22.5	- 3.70	- 5 37.5	+52 20 49.5	+0.78807	0.61217	+1.28734	-261	-336
0 43.0	- 7.07	- 10 45.5	+60 12 30	+0.86427	0.49816	+1.73495	-213	-369
1 51.5	-18.32	- 27 52.6	-25 46 22.4	-0.43224	0.90127	-0.47959	-385	+184
19 13.8	+47.02	+ 71 33.5	+42 30 13	+0.67215	0.73839	+0.91029	-315	-287
18 58.8	+49.48	+ 75 18.2	+40 00 40.1	+0.63952	0.76700	+0.83379	-327	-273
0 34.9	- 5.73	- 8 43.3	+49 23 54.6	+0.75568	0.65212	+1.15882	-278	-322
0 50.4	- 8.28	- 12 36.4	+56 02 22	+0.82576	0.55992	+1.47478	-239	-352
1 39.8	-16.40	- 24 57.3	+60 09 42.3	+0.86379	0.49882	+1.73168	-213	-369
1 39.8	-16.40	- 24 57.5	+60 09 20	+0.86374	0.49891	+1.73124	-213	-369
1 39.7	-16.38	- 24 56.1	+60 09 48	+0.86381	0.49880	+1.73179	-213	-369
2 05.4	-20.59	- 31 20.5	+29 51 31.1	+0.49494	0.86800	+0.57021	-370	-211
0 01.4	- 0.22	- 0 20.3	+50 52 18	+0.77209	0.63234	+1.22099	-270	-329
0 27.4	- 4.50	- 6 51.0	+50 09 47.1	+0.76429	0.64193	+1.19061	-274	-326
0 20.2	- 3.32	- 5 03.2	+52 38 38.4	+0.79122	0.60806	+1.30122	-259	-338
5 13.8	-51.55	- 78 27.2	+17 25 54.3	+0.29767	0.95445	+0.31188	-407	-127
0 45.5	- 7.48	- 11 22.9	+47 16 05.40	+0.73100	0.67987	+1.07521	-290	-312
17 53.9	+60.15	+ 91 32.0	+41 39 44	+0.66128	0.74822	+0.88380	-319	-282
6 57.4	-68.56	-104 20.7	+52 16 44.4	+0.78740	0.61315	+1.28418	-262	-336
6 57.1	-68.52	-104 16.8	+52 16 27	+0.78734	0.61322	+1.28395	-262	-336
1 55.9	-19.03	- 28 58.0	+41 00 45	+0.65277	0.75567	+0.86382	-322	-278
18 54.1	+50.25	+ 76 28.6	+42 27 10.4	+0.67150	0.73900	+0.90867	-315	-286
7 07.5	-70.23	-106 53.0	- 6 15 38.5	-0.10832	0.99408	-0.10897	-424	+ 46
0 46.9	- 7.70	- 11 42.8	+50 58 51	+0.77332	0.63089	+1.22575	-269	-330
0 46.3	- 7.61	- 11 35.1	+50 55 35.6	+0.77271	0.63161	+1.22339	-269	-330

If the horizontal parallax, $\pi=8''.80/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha = \frac{\pi}{\sin \delta} \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h = \theta - \alpha$ and $\theta = \text{sidereal time at } 0^{\text{h}} + \text{sidereal equivalent of U.T.} - \lambda$

Otherwise add $\Delta X = \Delta_{\alpha} \cos \theta$, $\Delta Y = \Delta_{\delta} \sin \theta$, ΔZ to solar coordinates to eliminate parallax.

Place	Description	Altitude	Longitude		
		m	h	m	s
Johannesburg, South Africa . . .	Republic Observatory	1806	-1	52	18.0
Juvisy, France	Flammarion Observatory	92	-0	09	29.0
Kaliningrad, R. S. F. S. R. . . .	University Observatory	24	-1	21	58.97 c
Kalocsa, Hungary	Archiepiscopal Haynald Observatory	117	-1	15	54.12 c
Kanzelhöhe, Austria	Observatory of the University of Graz	1526	-0	55	37.6
Karlsruhe, Germany	Observatory of W. Malsch	128	-0	33	32.51
Kazan, R. S. F. S. R.	Engelhardt Observatory	98	-3	15	15.74 c
Kazan, R. S. F. S. R.	Astronomical Obs. of State University	79	-3	16	29.03
Kharkov, Ukrainian S. S. R. . . .	Astronomical Obs. of State University	138	-2	24	55.72 c
Kiev, Ukrainian S. S. R.	Astronomical Obs. of State University	184	-2	02	00.56 c
Kitab, Uzbek S. S. R.	International Latitude Observatory	658	-4	27	31.7 d
Kodaikanal, India	Solar Physics Observatory	2343	-5	09	52.47
Kremsmünster, Austria	Observatory of the Benedictines	384	-0	56	31.58 c
Ksara, Syria	Ksara Observatory, near Beirut	923	-2	23	33.77
Kunming, China	National Institute of Astronomy	1940	-6	51	09.2
Kyoto, Japan	Kwasan Observatory	234	-9	03	10.40 a
Lake Angelus, Michigan	McMath-Hulbert Observatory ¹	296	+5	33	03.3
La Plata, Argentina	National University Observatory	17	+3	51	43.72 c
Leiden, Netherlands	University Observatory	6	-0	17	56.15 c
Leipzig, Germany	University Observatory	119	-0	49	33.92
Lembang, Indonesia	Bosscha Observatory	1300	-7	10	27.84
Leningrad, R. S. F. S. R.	Astronomical Obs. of State University	3	-2	01	10.71 c
Liège, Belgium	University Observatory, Cointe	127	-0	22	15.44
Lisbon, Portugal	Lisbon Observatory, at Tapada	95	+0	36	44.68 a
Lisbon, Portugal	Observatory of Faculty of Sciences	77	+0	36	35.61
Los Angeles, California	Griffith Observatory	357	+7	53	12.4 a
Louisville, Kentucky	Observatory of University of Louisville	152	+5	43	02.4 b
Lund, Sweden	Royal University Observatory	34	-0	52	44.97
Lvov, Ukrainian S. S. R.	Astronomical Institute of the University	330	-1	36	07.13
Lvov, Ukrainian S. S. R.	Observatory of the Polytechnic Institute	340	-1	36	03.40 c
Lyons, France	University Observatory	299	-0	19	08.52 c
Madison, Wisconsin	Washburn Obs., University of Wisconsin	292	+5	57	37.90 c
Madras, India	Madras Observatory	7	-5	20	59.14
Madrid, Spain	Astronomical Observatory	655	+0	14	45.10
Marseilles, France	National Observatory, at Longchamp	75	-0	21	34.55 c
Meudon, France	Observatory of Physical Astronomy	162	-0	08	55.5
Middletown, Connecticut	Van Vleck Obs., Wesleyan University	65	+4	50	38.2 a
Milan, Italy	Brera Observatory	120	-0	36	45.89 a
Mill Hill, London	Observatory of University of London	82	+0	00	57.77
Minneapolis, Minnesota	Observatory of University of Minnesota	260	+6	12	57.04 c
Mizusawa, Japan	International Latitude Observatory	61	-9	24	31.46 d
Montevideo, Uruguay	National Observatory	24	+3	44	51
Montreal, Quebec	McGill University Observatory	57	+4	54	18.63 c
Montreal, Quebec	Ville-Marie Observatory	69	+4	54	29.2
Moscow, R. S. F. S. R.	Observatory of Sternberg Inst.	166	-2	30	16.95 c

a Equatorial refractor

b Equatorial reflector

c Transit or meridian circle

d Zenith telescope

¹ Branch of the Observatory of the University of Michigan

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δx	ΔZ
h m	s	° '	° ' "					
1 52.3	-18.45	- 28 04.5	-26 10 55.3	-0.43867	0.89824	-0.48837	-383	+187
0 09.5	- 1.56	- 2 22.3	+48 41 37	+0.74757	0.66135	+1.13037	-282	-319
1 22.0	-13.47	- 20 29.7	+54 42 50.5	+0.81262	0.57896	+1.40358	-247	-347
1 15.9	-12.47	- 18 58.5	+46 31 41.7	+0.72213	0.68923	+1.04773	-294	-308
0 55.6	- 9.14	- 13 54.4	+46 40 41	+0.72408	0.68749	+1.05323	-293	-309
0 33.5	- 5.51	- 8 23.1	+49 01 26.6	+0.75137	0.65701	+1.14360	-280	-321
3 15.3	-32.08	- 48 48.9	+55 50 20.2	+0.82381	0.56283	+1.46370	-240	-351
3 16.5	-32.28	- 49 07.3	+55 47 23.9	+0.82333	0.56353	+1.46102	-240	-351
2 24.9	-23.81	- 36 13.9	+50 00 09.9	+0.76245	0.64404	+1.18386	-275	-325
2 02.0	-20.04	- 30 30.1	+50 27 11.8	+0.76748	0.63800	+1.20296	-272	-327
4 27.5	-43.95	- 66 52.9	+39 08 01.7	+0.62780	0.77680	+0.80819	-331	-268
5 09.9	-50.90	- 77 28.1	+10 13 50	+0.17650	0.98457	+0.17927	-420	- 75
0 56.5	- 9.29	- 14 07.9	+48 03 23.1	+0.74023	0.66968	+1.10533	-286	-316
2 23.6	-23.58	- 35 53.4	+33 49 25.6	+0.55356	0.83174	+0.66554	-355	-236
6 51.2	-67.54	-102 47.3	+25 01 32.0	+0.42056	0.90694	+0.46371	-387	-179
9 03.2	-89.23	-135 47.6	+34 59 40.8	+0.57030	0.82014	+0.69536	-350	-243
18 26.9	+54.71	+ 83 15.8	+42 39 47.7	+0.67420	0.73652	+0.91539	-314	-288
20 08.3	+38.07	+ 57 55.9	-34 54 30.3	-0.56905	0.82097	-0.69314	-350	+243
0 17.9	- 2.95	- 4 29.0	+52 09 19.8	+0.78602	0.61481	+1.27847	-262	-335
0 49.6	- 8.14	- 12 23.5	+51 20 05.9	+0.77717	0.62606	+1.24136	-267	-332
7 10.5	-70.71	-107 37.0	- 6 49 32.9	-0.11808	0.99316	-0.11889	-424	+ 50
2 01.2	-19.91	- 30 17.7	+59 56 32.2	+0.86188	0.50214	+1.71641	-214	-368
0 22.3	- 3.66	- 5 33.9	+50 37 06	+0.76930	0.63577	+1.21002	-271	-328
23 23.3	+ 6.04	+ 9 11.2	+38 42 30.7	+0.62198	0.78138	+0.79601	-333	-265
23 23.4	+ 6.01	+ 9 08.9	+38 43 03.5	+0.62210	0.78128	+0.79627	-333	-265
16 06.8	+77.74	+118 18.1	+34 06 46.8	+0.55768	0.82886	+0.67283	-354	-238
18 17.0	+56.35	+ 85 45.6	+38 12 50	+0.61525	0.78674	+0.78202	-336	-262
0 52.7	- 8.67	- 13 11.2	+55 41 51.6	+0.82241	0.56486	+1.45596	-241	-351
1 36.1	-15.79	- 24 01.8	+49 49 57.6	+0.76056	0.64632	+1.17675	-276	-324
1 36.1	-15.78	- 24 00.8	+49 50 11.2	+0.76060	0.64628	+1.17690	-276	-325
0 19.1	- 3.14	- 4 47.1	+45 41 41.0	+0.71208	0.69972	+1.01766	-299	-304
18 02.4	+58.75	+ 89 24.5	+43 04 36.8	+0.67949	0.73162	+0.92874	-312	-290
5 21.0	-52.73	- 80 14.8	+13 04 08.0	+0.22464	0.97427	+0.23057	-416	- 96
23 45.2	+ 2.42	+ 3 41.3	+40 24 30.0	+0.64485	0.76260	+0.84560	-325	-275
0 21.6	- 3.54	- 5 23.6	+43 18 16.3	+0.68235	0.72888	+0.93616	-311	-291
0 08.9	- 1.47	- 2 13.9	+48 48 18	+0.74886	0.65990	+1.13481	-282	-319
19 09.4	+47.74	+ 72 39.5	+41 33 18	+0.65986	0.74944	+0.88048	-320	-282
0 36.8	- 6.04	- 9 11.5	+45 27 59.2	+0.70927	0.70254	+1.00958	-300	-303
23 59.0	+ 0.16	+ 0 14.4	+51 36 46.3	+0.78019	0.62227	+1.25378	-265	-333
17 47.0	+61.27	+ 93 14.3	+44 58 40.0	+0.70329	0.70860	+0.99251	-302	-300
9 24.5	-92.74	-141 07.9	+39 08 03.4	+0.62774	0.77672	+0.80820	-331	-268
20 15.2	+36.94	+ 56 12.7	-34 54 33	-0.56906	0.82097	-0.69316	-350	+243
19 05.7	+48.35	+ 73 34.7	+45 30 20	+0.70974	0.70205	+1.01096	-300	-303
19 05.5	+48.38	+ 73 37.3	+45 28 22	+0.70934	0.70246	+1.00981	-300	-303
2 30.3	-24.69	- 37 34.2	+55 45 19.8	+0.82300	0.56404	+1.45912	-241	-351

If the horizontal parallax, $\pi=8''.80/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha = \frac{\pi}{\sin \delta} \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h = \theta - \alpha$ and θ = sidereal time at 0^h + sidereal equivalent of U. T. - λ

Otherwise add $\Delta X = \Delta x \cos \theta$, $\Delta Y = \Delta x \sin \theta$, ΔZ to solar coordinates to eliminate parallax.

Place	Description	Altitude	Longitude
		m	h m s
Mount Hamilton, California . . .	Lick Obs., University of California	1283	+ 8 06 34.93 c
Mount Wilson, California . . .	Observatory of Carnegie Institution	1742	+ 7 52 14.33 b
Mount Wilson, California . . .	Branch of Smithsonian Astro. Obs.	1675	+ 7 52 14.3
Munich, Germany	University Observatory	535	- 0 46 26.02
Naini Tal, India	Uttar Pradesh State Observatory	1927	- 5 17 49.71
Nanking, China	Purple Mountain Observatory	367	- 7 55 17.02
Nantucket, Massachusetts . . .	Maria Mitchell Observatory	20	+ 4 40 25.15 a
Naples, Italy	Astronomical Obs., at Capodimonte	164	- 0 57 01.41 a
Nashville, Tennessee	Arthur J. Dyer Obs., Vanderbilt Univ.	345	+ 5 47 13.27 b
Neuchâtel, Switzerland	Cantonal Observatory	488	- 0 27 49.79 c
New Haven, Connecticut	Yale University Observatory	21	+ 4 51 41.97
New Plymouth, New Zealand . .	Obs. of New Plymouth Astronomical Soc.	49	-11 36 17.77 a
New York, New York	Columbia University Observatory	25	+ 4 55 50
Nice, France	Nice Observatory, at Mont Gros	376	- 0 29 12.10 c
Nikolaev, Ukrainian S. S. R. . .	Astronomical Observatory	54	- 2 07 53.92 c
Norman, Oklahoma	Observatory of University of Oklahoma	363	+ 6 29 46.48
Northampton, Massachusetts . .	Smith College Observatory	70	+ 4 50 33.10 c
Northfield, Minnesota	Goodsell Observatory, Carleton College	290	+ 6 12 35.92 c
Oakland, California	Chabot Observatory	99	+ 8 08 48
Odessa, Ukrainian S. S. R. . . .	Odessa Observatory	53	- 2 03 01.98
Ondřejov, Czechoslovakia . . .	Astrophysical Observatory	533	- 0 59 08.08
Orono, Maine	Observatory of University of Maine	38	+ 4 34 40.3
Ottawa, Ontario	Dominion Observatory	87	+ 5 02 51.95 c
Oxford, England	University Observatory	64	+ 0 05 00.4 c
Oxford, Mississippi	Obs. of University of Mississippi	161	+ 5 58 07.18
Padua, Italy	Astronomical Observatory	38	- 0 47 29.15
Palermo, Sicily	University Astronomical Observatory	72	- 0 53 25.87
Palomar Mountain, California . .	Palomar Observatory ¹	1706	+ 7 47 27.36 b
Paris, France	Observatory of Paris ²	67	- 0 09 20.91 c
Perth, Western Australia	Government Observatory	65	- 7 43 21.62 a
Philadelphia, Pennsylvania . . .	Flower and Cook Obs., Univ. of Pa.	155	+ 5 01 54.33 b
Philadelphia, Pennsylvania . . .	Students' Obs., Univ. of Pennsylvania	21	+ 5 00 44
Philadelphia, Pennsylvania . . .	Franklin Institute Observatory	30	+ 5 00 41.6 a
Pic du Midi, France	Observatory of University of Toulouse	2862	- 0 00 34.16 a
Pittsburgh, Pennsylvania	Allegheny Obs. of the University	370	+ 5 20 05.34 a
Pola, Italy	Observatory of Hydrographic Office	32	- 0 55 23.07 c
Poltava, Ukrainian S. S. R. . . .	Gravimetric Observatory	151	- 2 18 11.2
Portage Lake, Michigan	Portage Lake Observatory ³	321	+ 5 35 41.93 b
Potsdam, Germany	Astrophysical Observatory	107	- 0 52 15.86 a
Potsdam, Germany	Geodetic Institute ⁴	109	- 0 52 16.11
Poughkeepsie, New York	Vassar College Observatory	61	+ 4 55 35.16 c
Poznań, Poland	University Observatory	85	- 1 07 30.78 a
Prague, Czechoslovakia	Stefánik Observatory	327	- 0 57 35.8
Prague, Czechoslovakia	Astronomical Institute of Charles Univ.	267	- 0 57 34.88
Prague, Czechoslovakia	Technical University Observatory	237	- 0 57 40.92

a Equatorial refractor b Equatorial reflector c Transit or meridian circle d Zenith telescope

¹ Of Carnegie Institution of Washington and California Institute of Technology
² Cassini's Meridian ³ Branch of the Observatory of University of Michigan
⁴ Helmert Tower; zero of the German triangulation

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δz_s	ΔZ
h m	s	° '	° ' "					
15 53.4	+ 79.93	+121 38.7	+37 20 25.3	+0.60334	0.79619	+0.75778	-340	-257
16 07.8	+ 77.58	+118 03.6	+34 12 59.5	+0.55929	0.82802	+0.67545	-353	-239
16 07.8	+ 77.58	+118 03.6	+34 12 55	+0.55927	0.82803	+0.67542	-353	-239
0 46.4	- 7.63	- 11 36.5	+48 08 45.5	+0.74129	0.66854	+1.10882	-285	-316
5 17.8	- 52.21	- 79 27.4	+29 21 38.90	+0.48755	0.87252	+0.55879	-372	-208
7 55.3	- 78.08	-118 49.3	+32 03 59.9	+0.52787	0.84828	+0.62228	-362	-225
19 19.6	+ 46.07	+ 70 06.3	+41 16 50	+0.65627	0.75259	+0.87202	-321	-280
0 57.0	- 9.37	- 14 15.4	+40 51 45.7	+0.65080	0.75739	+0.85927	-323	-278
18 12.8	+ 57.04	+ 86 48.3	+36 03 08.5	+0.58528	0.80947	+0.72305	-345	-250
0 27.8	- 4.57	- 6 57.4	+46 59 50.6	+0.72777	0.68331	+1.06506	-292	-310
19 08.3	+ 47.92	+ 72 55.5	+41 18 58.4	+0.65674	0.75218	+0.87311	-321	-280
11 36.3	-114.38	-174 04.4	-39 03 45.2	-0.62677	0.77750	-0.80614	-332	+267
19 04.2	+ 48.60	+ 73 57.5	+40 48 34.6	+0.65009	0.75798	+0.85766	-323	-277
0 29.2	- 4.80	- 7 18.0	+43 43 17.0	+0.68765	0.72392	+0.94990	-309	-293
2 07.9	- 21.01	- 31 58.5	+46 58 18.5	+0.72742	0.68359	+1.06411	-292	-310
17 30.2	+ 64.03	+ 97 26.6	+35 12 08.3	+0.57326	0.81808	+0.70074	-349	-245
19 09.4	+ 47.73	+ 72 38.3	+42 19 01.9	+0.66974	0.74057	+0.90436	-316	-286
17 47.4	+ 61.21	+ 93 09.0	+44 27 41.6	+0.69690	0.71493	+0.97478	-305	-297
15 51.2	+ 80.30	+122 12.0	+37 47 00	+0.60934	0.79134	+0.77000	-338	-260
2 03.0	- 20.21	- 30 45.5	+46 28 37.5	+0.72151	0.68987	+1.04586	-294	-308
0 59.1	- 9.71	- 14 47.0	+49 54 38.1	+0.76146	0.64531	+1.18000	-275	-325
19 25.3	+ 45.12	+ 68 40.1	+44 54 00	+0.70231	0.70953	+0.98982	-303	-300
18 57.1	+ 49.75	+ 75 43.0	+45 23 38.1	+0.70838	0.70344	+1.00703	-300	-302
23 55.0	+ 0.82	+ 1 15.1	+51 45 34.2	+0.78177	0.62026	+1.26040	-265	-334
18 01.9	+ 58.83	+ 89 31.8	+34 22 12.6	+0.56136	0.82631	+0.67935	-353	-239
0 47.5	- 7.80	- 11 52.3	+45 24 01.3	+0.70846	0.70335	+1.00726	-300	-302
0 53.4	- 8.78	- 13 21.5	+38 06 43.6	+0.61385	0.78782	+0.77917	-336	-262
16 12.5	+ 76.79	+116 51.8	+33 21 22.4	+0.54685	0.83635	+0.65386	-357	-233
0 09.3	- 1.54	- 2 20.2	+48 50 11	+0.74921	0.65948	+1.13607	-281	-320
7 43.4	- 76.12	-115 50.4	-31 57 10.7	-0.52617	0.84929	-0.61954	-362	+224
18 58.1	+ 49.60	+ 75 28.6	+39 59 57	+0.63936	0.76714	+0.83343	-327	-273
18 59.3	+ 49.40	+ 75 11.0	+39 57	+0.63869	0.76767	+0.83198	-328	-272
18 59.3	+ 49.40	+ 75 10.4	+39 57 27.6	+0.63879	0.76759	+0.83221	-327	-273
0 00.6	- 0.09	- 0 08.5	+42 56 12.0	+0.67797	0.73358	+0.92420	-313	-289
18 39.9	+ 52.58	+ 80 01.3	+40 28 58.1	+0.64581	0.76173	+0.84782	-325	-276
0 55.4	- 9.10	- 13 50.8	+44 51 48.6	+0.70186	0.70998	+0.98856	-303	-299
2 18.2	- 22.70	- 34 32.8	+49 36 13.0	+0.75796	0.64935	+1.16725	-277	-323
18 24.3	+ 55.15	+ 83 55.5	+42 24 10.7	+0.67087	0.73959	+0.90708	-316	-286
0 52.3	- 8.59	- 13 04.0	+52 22 56.0	+0.78845	0.61169	+1.28897	-261	-336
0 52.3	- 8.59	- 13 04.0	+52 22 54.8	+0.78845	0.61170	+1.28895	-261	-336
19 04.4	+ 48.56	+ 73 53.8	+41 41 18	+0.66160	0.74789	+0.88461	-319	-282
1 07.5	- 11.09	- 16 52.7	+52 23 54.3	+0.78862	0.61147	+1.28972	-261	-336
0 57.6	- 9.46	- 14 23.9	+50 04 56	+0.76336	0.64299	+1.18720	-274	-326
0 57.6	- 9.46	- 14 23.7	+50 04 36.0	+0.76329	0.64306	+1.18696	-274	-326
0 57.7	- 9.48	- 14 25.2	+50 04 40.2	+0.76330	0.64304	+1.18701	-274	-326

If the horizontal parallax, $\pi=8''.80/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha = \frac{\pi}{\sin \delta} \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h = \theta - \alpha$ and θ = sidereal time at 0^h + sidereal equivalent of U.T. - λ

Otherwise add $\Delta X = \Delta z_s \cos \theta$, $\Delta Y = \Delta z_s \sin \theta$, ΔZ to solar coordinates to eliminate parallax.

Place	Description	Altitude	Longitude		
		m	h	m	s
Pretoria, South Africa	Radeliffe Observatory	1542	-	1 52	54.9 b
Pretoria, South Africa	Observatory of S. C. Venter	1234	-	1 52	46.9
Princeton, New Jersey	Princeton University Observatory	43	+	4 58	35.59
Princeton, New Jersey	Obs. of Instruction, Princeton Univ.	65	+	4 58	37.61 c
Providence, Rhode Island	Ladd Observatory, Brown University	69	+	4 45	35.95 a
Pulkovo, R. S. F. S. R.	Astronomical Obs. of Acad. of Sciences	75	-	2 01	18.57
Quebec, Canada	Quebec Observatory, Plains of Abraham	90	+	4 44	52.71 c
Quito, Ecuador	National Observatory	2908	+	5 13	58.20
Reutlingen, Germany	Popular Observatory	401	-	0 36	49.11
Richmond, Florida	Branch of United States Naval Obs.	—	+	5 21	31.3 d
Richmond Hill, Ontario	David Dunlap Obs., Univ. of Toronto	244	+	5 17	41.3
Riga, Latvian S. S. R.	Polytechnic School Observatory	—	-	1 36	28.10
Rio de Janeiro, Brazil	National Observatory	33	+	2 52	53.5 c
Rio de Janeiro, Brazil	Mount Valongo Obs., Univ. of Brazil	52	+	2 52	44.66 a
Rome, Italy	Rome Observatory, on Monte Mario	152	-	0 49	48.55 c
St. Louis, Missouri	Washington University Observatory	178	+	6 01	13.3
Saint Michel, France	Observatory of Haute-Provence	651	-	0 22	51.34
San Fernando, Spain	Naval Observatory	30	+	0 24	49.30
Santa Clara, California	Obs. of University of Santa Clara	31	+	8 07	48
Santiago, Chile	National Observatory	860	+	4 42	11.7
São Paulo, Brazil	Astronomical and Geophysical Institute	800	+	3 06	29.44
Scottsdale, Arizona	Mummy Mountain Astronomical Obs.	433	+	7 27	49.93
Sendai, Japan	Tohoku University Observatory	36	-	9 23	29.49
Sidmouth, Devon	Norman Lockyer Observatory	171	+	0 12	52.5 a
Simeis, Crimea, R. S. F. S. R.	Crimean Astrophysical Observatory	346	-	2 15	59.38
Skalná Pleso, Czechoslovakia	Astronomical Observatory	1783	-	1 20	58.8 b
Sneek, Netherlands	Observatory of A. Mak	0	-	0 22	39.46 a
Sonneberg, Germany	Sonneberg Observatory	640	-	0 44	46.19 a
South Bethlehem, Pennsylvania	Sayre Observatory, Lehigh University	110	+	5 01	31.96 a
South Hadley, Massachusetts	Williston Obs., Mount Holyoke Coll.	76	+	4 50	18.99 a
Stockholm, Sweden	Stockholm Observatory, at Saltsjöbaden	55	-	1 13	14 c
Strasbourg, France	University Observatory	156	-	0 31	04.25 a
Stuttgart, Germany	Swabian Observatory	344	-	0 36	47.39
Sunspot, New Mexico	Sacramento Peak Observatory	2811	+	7 03	16.6
Swarthmore, Pennsylvania	Sproul Observatory, Swarthmore College	63	+	5 01	25.62 a
Sydney, New South Wales	Government Observatory	44	-	10 04	49.19
Sydney, New South Wales	Riverview College Observatory	26	-	10 04	37.99 a
Syracuse, New York	Syracuse University Observatory	160	+	5 04	33.36
Szombathely (Savaria), Hungary	Gothard Astrophysical Observatory	232	-	1 06	29.78
Tacubaya, Mexico	National Observatory	2297	+	6 36	46.74
Tanakami, Japan	Yamamoto Observatory	165	-	9 03	57.4
Tartu, Estonian S. S. R.	Astronomical Obs. of Acad. of Sciences	67	-	1 46	53.18 c
Tashkent, Uzbek S. S. R.	Tashkent Observatory	477	-	4 37	10.47 c
Teramo, Italy	Collurania Observatory	398	-	0 54	56

a Equatorial refractor

b Equatorial reflector

c Transit or meridian circle

d Zenith telescope

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	$\Delta x''$	ΔZ
h m	s	° '	° ' "					
1 52.9	- 18.55	- 28 13.7	-25 47 18	-0.43250	0.90120	-0.47992	-384	+185
1 52.8	- 18.53	- 28 11.7	-25 40 15	-0.43064	0.90204	-0.47741	-385	+184
19 01.4	+ 49.05	+ 74 38.9	+40 20 47.7	+0.64397	0.76322	+0.84375	-326	-275
19 01.4	+ 49.06	+ 74 39.4	+40 20 57.8	+0.64401	0.76320	+0.84383	-326	-275
19 14.4	+ 46.92	+ 71 24.0	+41 50 15.6	+0.66354	0.74616	+0.88927	-318	-283
2 01.3	- 19.93	- 30 19.6	+59 46 18.5	+0.86039	0.50472	+1.70469	-215	-367
19 15.1	+ 46.80	+ 71 13.2	+46 47 59.2	+0.72537	0.68579	+1.05772	-293	-309
18 46.0	+ 51.58	+ 78 29.6	- 0 14 00	-0.00405	1.00045	-0.00404	-427	+ 2
0 36.8	- 6.05	- 9 12.3	+48 29 25.9	+0.74527	0.66404	+1.12232	-283	-318
18 38.5	+ 52.82	+ 80 22.8	+25 37 28	+0.42983	0.90222	+0.47642	-385	-183
18 42.3	+ 52.19	+ 79 25.3	+43 51 46	+0.68942	0.72219	+0.95461	-308	-294
1 36.5	- 15.85	- 24 07.0	+56 57 09.3	+0.83456	0.54662	+1.52675	-233	-356
21 07.1	+ 28.40	+ 43 13.4	-22 53 42.2	-0.38663	0.92169	-0.41948	-393	+165
21 07.3	+ 28.38	+ 43 11.2	-22 53 51.3	-0.38667	0.92168	-0.41953	-393	+165
0 49.8	- 8.18	- 12 27.2	+41 55 19.2	+0.66464	0.74519	+0.89191	-318	-284
17 58.8	+ 59.34	+ 90 18.3	+38 38 57.0	+0.62118	0.78203	+0.79432	-334	-265
0 22.9	- 3.75	- 5 42.8	+43 55 45.6	+0.69030	0.72144	+0.95683	-308	-294
23 35.2	+ 4.08	+ 6 12.3	+36 27 42.0	+0.59100	0.80522	+0.73396	-344	-252
15 52.2	+ 80.13	+121 57.0	+37 20 45	+0.60329	0.79598	+0.75793	-340	-257
19 17.8	+ 46.36	+ 70 32.9	-33 23 50	-0.54737	0.83584	-0.65488	-357	+233
20 53.5	+ 30.64	+ 46 37.4	-23 39 06.9	-0.39875	0.91661	-0.43503	-391	+170
16 32.2	+ 73.57	+111 57.5	+33 33 19.82	+0.54963	0.83426	+0.65882	-356	-234
9 23.5	- 92.57	-140 52.4	+38 15 14.9	+0.61579	0.78629	+0.78315	-335	-263
23 47.1	+ 2.11	+ 3 13.1	+50 41 13.3	+0.77007	0.63485	+1.21299	-271	-329
2 16.0	- 22.34	- 33 59.8	+44 24 11.6	+0.69618	0.71565	+0.97280	-305	-297
1 21.0	- 13.30	- 20 14.7	+49 11 20.0	+0.75344	0.65501	+1.15027	-279	-321
0 22.7	- 3.72	- 5 39.9	+53 02 25.0	+0.79540	0.60255	+1.32005	-257	-339
0 44.8	- 7.35	- 11 11.5	+50 22 41.4	+0.76670	0.63906	+1.19974	-273	-327
18 58.5	+ 49.53	+ 75 23.0	+40 36 23.2	+0.64742	0.76029	+0.85154	-324	-276
19 09.7	+ 47.69	+ 72 34.7	+42 15 18.2	+0.66894	0.74130	+0.90239	-316	-285
1 13.2	- 12.03	- 18 18.5	+59 16 18	+0.85596	0.51225	+1.67099	-219	-365
0 31.1	- 5.10	- 7 46.1	+48 35 02.1	+0.74631	0.66279	+1.12601	-283	-318
0 36.8	- 6.04	- 9 11.8	+48 47 00.7	+0.74863	0.66020	+1.13395	-282	-319
16 56.7	+ 69.53	+105 49.2	+32 47 12	+0.53864	0.84189	+0.63980	-359	-230
18 58.6	+ 49.52	+ 75 21.4	+39 54 16.2	+0.63809	0.76819	+0.83064	-328	-272
10 04.8	- 99.36	-151 12.3	-33 51 41.1	-0.55402	0.83126	-0.66648	-355	+236
10 04.6	- 99.33	-151 09.5	-33 49 45.7	-0.55356	0.83157	-0.66568	-355	+236
18 55.4	+ 50.03	+ 76 08.3	+43 02 13.1	+0.67896	0.73208	+0.92744	-312	-290
1 06.5	- 10.92	- 16 37.4	+47 13 53.48	+0.73052	0.68030	+1.07382	-290	-312
17 23.2	+ 65.18	+ 99 11.7	+19 24 17.9	+0.33025	0.94388	+0.34989	-403	-141
9 04.0	- 89.36	-135 59.3	+34 58 18	+0.56996	0.82036	+0.69477	-350	-243
1 46.9	- 17.56	- 26 43.3	+58 22 47.2	+0.84790	0.52557	+1.61327	-224	-362
4 37.2	- 45.53	- 69 17.6	+41 19 30.4	+0.65690	0.75213	+0.87339	-321	-280
0 54.9	- 9.02	- 13 44.0	+42 39 27	+0.67414	0.73660	+0.91521	-314	-288

If the horizontal parallax, $\pi=8''.80/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha=\pi \times \rho \cos \phi' \sin \delta \quad \Delta\delta=\pi \times \rho \sin \phi' (\tan \phi' \cos \delta - \cos \delta \sin \delta)$$

where $h=\theta-\alpha$ and θ =sidereal time at 0^h+sidereal equivalent of U.T.- λ

Otherwise add $\Delta X=\Delta x'' \cos \theta$, $\Delta Y=\Delta x'' \sin \theta$, ΔZ to solar coordinates to eliminate parallax.

Place	Description	Altitude	Longitude		
		m	h	m	s
Tisvildeleje, Denmark	Observatory of N.P. Wieth-Knudsen	35	-	0 48	23.8
Tokyo, Japan	Tokyo Astronomical Obs., at Mitaka	59	-	9 18	10.10 c
Tomsk, R. S. F. S. R.	University Observatory	130	-	5 39	47.16
Tonantzintla, Mexico	National Astrophysical Observatory	2150	+	6 33	15.32
Toronto, Canada	Meteorological Observatory	116	+	5 17	35.60 c
Toruń, Poland	Copernicus University Obs., at Piwnice	90	-	1 14	13.1
Toulouse, France	University Observatory	195	-	0 05	51.01 c
Trieste, Italy	Astronomical Observatory	67	-	0 55	04.9
Troy, New York	Obs. of Rensselaer Polytechnic Inst.	82	+	4 54	43
Tsingtao, China	Observatory of Tsingtao	78	-	8 01	16.71 c
Tucson, Arizona	Catalina Station, University of Arizona	—	+	7 22	52
Tucson, Arizona	Kitt Peak National Observatory	2064	+	7 26	22.72
Tucson, Arizona	Steward Obs., University of Arizona	757	+	7 23	47.68 b
Turin, Italy	Pino Torinese Observatory	618	-	0 31	05.95 c
Turku, Finland	University Observatory	28	-	1 28	55.03 b
Uccle, Belgium	Royal Observatory	105	-	0 17	25.97 c
Ukiah, California	International Latitude Observatory	200	+	8 12	50.3 d
University, Alabama	Observatory, University of Alabama	87	+	5 50	10.2
Uppsala, Sweden	University Astronomical Observatory	21	-	1 10	30.17 a
Urbana, Illinois	Observatory, University of Illinois	236	+	5 52	53.90 a
Utrecht, Netherlands	Sonnenborgh Observatory	14	-	0 20	31.01 a
Venice, Italy	Observatory of the Nautical Institute	15	-	0 49	22.12 c
Victoria, British Columbia	Dominion Astrophysical Observatory	229	+	8 13	40.17 b
Vienna, Austria	Kuffner Observatory	293	-	1 05	10.96
Vienna, Austria	University Observatory	240	-	1 05	21.35 c
Vilnius, Lithuanian S. S. R.	University Observatory	122	-	1 41	08.76 a
Warsaw, Poland	Observatory of the Technical University	144	-	1 24	02.4
Warsaw, Poland	University Observatory	121	-	1 24	07.26
Washington, D. C.	United States Naval Observatory	86*	+	5 08	15.78 a
Washington, D. C.	Georgetown College Observatory	62	+	5 08	18.3 a
Washington, D. C.	Smithsonian Astrophysical Observatory	10	+	5 08	06.24
Weesp, Netherlands	Observatory of J. van Diggelen	—	-	0 20	09.38
Wellesley, Massachusetts	Whitin Observatory, Wellesley College	61	+	4 45	13.3
Wellington, New Zealand	Carter Observatory	129	-	11 39	03.69 a
Williams Bay, Wisconsin	Yerkes Obs., University of Chicago	334	+	5 54	13.64 a
Williamstown, Massachusetts	Field Memorial Obs., Williams College	213	+	4 52	50
Wilmington, Delaware	Mt. Cuba Astronomical Observatory	90	+	5 02	32 b
Wroclaw, Poland	University Observatory	117	-	1 08	21.22
Würzburg, Germany	University Observatory	200	-	0 39	44.71
Zagreb, Yugoslavia	Observatory of Faculty of Technology	146	-	1 04	05.11
Zô-Sô, China	Astronomical Observatory	100	-	8 04	44.75 a
Zürich, Switzerland	Obs. of Swiss Polytechnic School	469	-	0 34	12.26 c

a Equatorial refractor

b Equatorial reflector

c Transit or meridian circle

d Zenith telescope

*Bench mark in clock house; $\lambda = +5^{\circ} 08' 15''.78$, $\phi = +38^{\circ} 55' 14''.0$.

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δx	ΔZ
h m	s	° ' "	° ' "					
0 48.4	- 7.95	- 12 06.0	+56 03 03	+0.82587	0.55976	+1.47541	-239	-352
9 18.2	- 91.69	-139 32.5	+35 40 21.4	+0.57990	0.81330	+0.71302	-347	-247
5 39.8	- 55.82	- 84 56.8	+56 28 06.3	+0.82993	0.55370	+1.49888	-236	-354
17 26.7	+ 64.60	+ 98 18.8	+19 01 57.9	+0.32414	0.94599	+0.34265	-404	-138
18 42.4	+ 52.17	+ 79 23.9	+43 40 00.8	+0.68694	0.72454	+0.94810	-309	-293
1 14.2	- 12.19	- 18 33.3	+53 05 47.7	+0.79600	0.60177	+1.32276	-257	-340
0 05.9	- 0.96	- 1 27.8	+43 36 44.1	+0.68626	0.72521	+0.94629	-309	-293
0 55.1	- 9.05	- 13 46.2	+45 38 35.5	+0.71142	0.70034	+1.01583	-299	-304
19 05.3	+ 48.42	+ 73 40.8	+42 43 45	+0.67503	0.73572	+0.91751	-314	-288
8 01.3	- 79.06	-120 19.2	+36 04 11.3	+0.58550	0.80925	+0.72351	-345	-250
16 37.1	+ 72.75	+110 43	+32 24	+0.53274	0.84514	+0.63035	-361	-227
16 33.6	+ 73.33	+111 35.7	+31 57 30.32	+0.52641	0.84951	+0.61967	-362	-225
16 36.2	+ 72.90	+110 56.9	+32 13 59.4	+0.53035	0.84680	+0.62630	-361	-226
0 31.1	- 5.11	- 7 46.5	+45 02 16.3	+0.70407	0.70790	+0.99459	-302	-300
1 28.9	- 14.61	- 22 13.8	+60 27 08.7	+0.86631	0.49441	+1.75221	-211	-370
0 17.4	- 2.86	- 4 21.5	+50 47 55.0	+0.77129	0.63334	+1.21782	-270	-329
15 47.2	+ 80.96	+123 12.6	+39 08 12.0	+0.62779	0.77671	+0.80827	-331	-268
18 09.8	+ 57.52	+ 87 32.6	+33 12 33	+0.54457	0.83753	+0.65021	-357	-232
1 10.5	- 11.58	- 17 37.5	+59 51 29.4	+0.86114	0.50341	+1.71061	-215	-367
18 07.1	+ 57.97	+ 88 13.5	+40 06 20.2	+0.64079	0.76596	+0.83658	-327	-273
0 20.5	- 3.37	- 5 07.8	+52 05 09.6	+0.78528	0.61577	+1.27528	-263	-335
0 49.4	- 8.11	- 12 20.5	+45 26 10.5	+0.70889	0.70290	+1.00852	-300	-302
15 46.3	+ 81.10	+123 25.0	+48 31 15.7	+0.74560	0.66362	+1.12353	-283	-318
1 05.2	- 10.71	- 16 17.7	+48 12 46.7	+0.74204	0.66764	+1.11143	-285	-317
1 05.4	- 10.74	- 16 20.3	+48 13 55.1	+0.74225	0.66739	+1.11217	-285	-317
1 41.1	- 16.62	- 25 17.2	+54 40 59.1	+0.81232	0.57941	+1.40198	-247	-347
1 24.0	- 13.80	- 21 00.6	+52 13 21	+0.78675	0.61390	+1.28157	-262	-336
1 24.1	- 13.82	- 21 01.8	+52 13 04.6	+0.78670	0.61396	+1.28135	-262	-336
18 51.7	+ 50.64	+ 77 03.9	+38 55 14.0	+0.62486	0.77906	+0.80206	-332	-267
18 51.7	+ 50.65	+ 77 04.6	+38 54 26.0	+0.62467	0.77921	+0.80168	-332	-267
18 51.9	+ 50.61	+ 77 01.6	+38 53 17.3	+0.62441	0.77941	+0.80113	-333	-266
0 20.2	- 3.31	- 5 02.3	+52 18 11.8	+0.78760	0.61277	+1.28530	-261	-336
19 14.8	+ 46.85	+ 71 18.3	+42 17 37.1	+0.66943	0.74084	+0.90361	-316	-286
11 39.1	-114.84	-174 45.9	-41 17 03.9	-0.65634	0.75256	-0.87214	-321	+280
18 05.8	+ 58.19	+ 88 33.4	+42 34 13.4	+0.67302	0.73762	+0.91242	-315	-287
19 07.2	+ 48.10	+ 73 12.5	+42 42 30	+0.67477	0.73598	+0.91684	-314	-288
18 57.5	+ 49.70	+ 75 38.0	+39 47 03	+0.63648	0.76953	+0.82710	-328	-272
1 08.4	- 11.23	- 17 05.3	+51 06 42.1	+0.77473	0.62910	+1.23150	-268	-331
0 39.7	- 6.53	- 9 56.2	+49 47 27.6	+0.76008	0.64687	+1.17501	-276	-324
1 04.1	- 10.53	- 16 01.3	+45 49 32.3	+0.71365	0.69807	+1.02232	-298	-304
8 04.7	- 79.63	-121 11.2	+31 05 47.6	+0.51348	0.85708	+0.59910	-366	-219
0 34.2	- 5.62	- 8 33.1	+47 22 38.3	+0.73227	0.67845	+1.07932	-289	-312

If the horizontal parallax, $\pi=8''.80/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha=\frac{1}{\sin\delta}\pi\times\rho\cos\phi'\sin h\sec\delta \quad \Delta\delta=\pi\times\rho\cos\phi'(\tan\phi'\cos\delta-\cos h\sin\delta)$$

where $h=\theta-\alpha$ and θ =sidereal time at 0^h+sidereal equivalent of U.T.- λ

Otherwise add $\Delta X=\Delta_{xy}\cos\theta$, $\Delta Y=\Delta_{xy}\sin\theta$, ΔZ to solar coordinates to eliminate parallax.

Place	Description	Altitude	Longitude
		m	h m s
Achimota, Ghana	University of Ghana	18	+ 0 00 54.67
Arcetri (Florence), Italy . . .	Astrophysical Observatory	184	- 0 45 01.30
Arecibo, Puerto Rico	Arecibo Ionospheric Obs., Cornell Univ.	364	+ 4 27 00.70
Berlin-Adlershof, Germany . . .	Heinrich-Hertz Institute	50	- 0 54 09.7
Bethany, Connecticut	Yale University Observatory	213	+ 4 51 56.3
Big Pine, California	California Institute of Technology	1216	+ 7 53 10.56
Boulder, Colorado	High Altitude Observatory, Univ. of Colorado	1692	+ 7 01 05.87
Boulder, Colorado	National Bureau of Standards Field Station	1595	+ 7 00 29.47
Cambridge, England	Mullard Radio Astro. Obs., Univ. of Cambridge	26	- 0 00 09.6
Cedar Rapids, Iowa	Feather Ridge Observatory	275	+ 6 06 59.3
Christchurch, New Zealand . . .	Aerospace Field Station, U. of Canterbury	35	-11 29 37.33
College, Alaska	Stanford Research Institute	122	+ 9 50 36.0
College, Alaska	Geophysical Institute of University of Alaska	172	+ 9 51 20
Columbus, Ohio	Radio Observatory, Ohio State University	245	+ 5 32 10.24
Crimea, R. S. F. S. R.	Crimean Astrophysical Observatory	550	- 2 16 04
Danville, Illinois	Vermilion River Observatory, University of Illinois	202	+ 5 50 15.65
Delaware, Ohio	Ohio State-Ohio Wesleyan Radio Observatory	282	+ 5 32 11.56
Derwood, Maryland	Carnegie Institution of Washington	140	+ 5 08 36.3
Dwingeloo, Netherlands	Foundation for Radio Astronomy	25	- 0 25 35.25
Eschweiler, Germany	Stockert Radio Obs. of Bonn University	435	- 0 26 53.48
Fort Davis, Texas	Radio Astronomy Station of Harvard Col. Obs.	1580	+ 6 55 48
Freiburg, Germany	Fraunhofer Institute	1240	- 0 31 37.4
Gainesville, Florida	Observatory of the University of Florida	38	+ 5 29 22.47
Goldstone, California	Jet Propulsion Lab., Calif. Inst. of Tech.	1038	+ 7 47 23.58
Gothenburg, Sweden	Onsala Obs., Chalmers Univ. of Technology	14	- 0 47 40
Grafton, New York	Sampson Sta., Rensselaer Polytechnic Inst.	493	+ 4 53 48
Green Bank, West Virginia . . .	National Radio Astronomy Observatory	823	+ 5 19 20.7
Hamilton, Massachusetts	Sagamore Hill Radio Observatory, U.S.A.F.	—	+ 4 43 15.69
Harestua, Norway	Observatory of the University of Oslo	585	- 0 43 02
Harvard, Massachusetts	George R. Agassiz Station of Harvard Obs.	183	+ 4 46 14.2
Hat Creek, California	Radio Observatory, Univ. of California	1050	+ 8 05 53.52
Helsinki, Finland	Radio Astronomy Station, Univ. of Helsinki	2	- 1 40 02
Hiraiso, Japan	Hiraiso Radio Wave Observatory	26	- 9 22 29.5
Humain, Belgium	Humain Station, Royal Obs. of Belgium	294	- 0 21 01.7
Ikomasan, Japan	Ikomasan Observatory, Kyoto University	634	- 9 02 41.52
Ithaca, New York	Radio Astronomy Laboratory, Cornell Univ.	341	+ 5 05 48.46
Jodrell Bank, Cheshire	Nuffield Radio Ast. Lab., Univ. of Manchester	70	+ 0 09 13.47
Kiel, Germany	Radio Observatory, University of Kiel	38	- 0 40 29.0
Kingston, Ontario	Radio Observatory, Queen's University	110	+ 5 06 32
Lwiro, Congo	Radio Astronomy Observing Station of Lwiro	1700	- 1 55 16
Malvern, England	Royal Radar Establishment	20	+ 0 08 35.3
Nançay, France	Radio Obs. of Nançay, Observatory of Paris	150	- 0 08 47.3
Nederhorst den Berg, Netherlands .	Radio Astronomy Section, NERA	0	- 0 20 18.5
Newstead, New York	Radio Physics Observatory of Cornell Univ.	238	+ 5 14 14.9
Ottawa, Ontario	Shirley Bay Radio Observatory	70	+ 5 03 39.5

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δx	ΔZ
h m	s	° '	° ' "					
23 59.1	+ 0.15	+ 0 13.7	+ 5 38	+0.09750	0.99521	+0.09797	-425	- 42
0 45.0	- 7.40	- 11 15.3	+43 45 14.4	+0.68804	0.72350	+0.95099	-309	-294
19 33.0	+43.86	+ 66 45.2	+18 20 46.2	+0.31276	0.94954	+0.32938	-405	-133
0 54.2	- 8.90	- 13 32.4	+52 25 45	+0.78895	0.61104	+1.29116	-261	-337
19 08.1	+47.96	+ 72 59.1	+41 25 37	+0.65821	0.75093	+0.87652	-320	-281
16 06.8	+77.73	+118 17.6	+37 13 53.8	+0.60183	0.79733	+0.75480	-340	-257
16 58.9	+69.18	+105 16.5	+40 04 42	+0.64057	0.76644	+0.83578	-327	-273
16 59.5	+69.08	+105 07.4	+40 05 28	+0.64073	0.76628	+0.83616	-327	-273
0 00.2	- 0.03	- 0 02.4	+52 09 45	+0.78610	0.61472	+1.27880	-262	-335
17 53.0	+60.29	+ 91 44.8	+42 04 59	+0.66674	0.74333	+0.89696	-317	-284
11 29.6	-113.29	-172 24.3	-43 37 10	-0.68633	0.72510	-0.94653	-309	+293
14 09.4	+97.02	+147 39.0	+64 44 00	+0.90075	0.42802	+2.10447	-183	-384
14 08.7	+97.14	+147 50.0	+64 52.4	+0.90180	0.42581	+2.11786	-182	-385
18 27.8	+54.57	+ 83 02.6	+40 01 00.2	+0.63960	0.76695	+0.83395	-327	-273
2 16.1	-22.35	- 34 01.0	+44 43.7	+0.70024	0.71170	+0.98390	-304	-299
18 09.7	+57.54	+ 87 33.9	+40 03 36.0	+0.64018	0.76646	+0.83523	-327	-273
18 27.8	+54.57	+ 83 02.9	+40 15 04.7	+0.64273	0.76432	+0.84091	-326	-274
18 51.4	+50.70	+ 77 09.1	+39 07 15	+0.62757	0.77687	+0.80781	-331	-268
0 25.6	- 4.20	- 6 23.8	+52 48 46.7	+0.79301	0.60571	+1.30921	-258	-338
0 26.9	- 4.42	- 6 43.4	+50 34 14	+0.76881	0.63645	+1.20797	-272	-328
17 04.2	+68.30	+103 57.0	+30 38	+0.50668	0.86141	+0.58820	-367	-216
0 31.6	- 5.20	- 7 54.4	+47 54 50	+0.73866	0.67162	+1.09982	-286	-315
18 30.6	+54.11	+ 82 20.6	+29 38 36	+0.49168	0.86984	+0.56525	-371	-210
16 12.6	+76.78	+116 50.9	+35 23 34.2	+0.57603	0.81625	+0.70570	-348	-246
0 47.7	- 7.83	- 11 55.0	+57 23.5	+0.83872	0.54018	+1.55265	-230	-358
19 06.2	+48.26	+ 73 27	+42 47 35	+0.67589	0.73501	+0.91956	-314	-288
18 40.7	+52.46	+ 79 50.2	+38 26 17	+0.61837	0.78440	+0.78834	-335	-264
19 16.7	+46.53	+ 70 48.9	+42 37 51.2	+0.67376	0.73687	+0.91435	-314	-287
0 43.0	- 7.07	- 10 45.5	+60 12 30	+0.86427	0.49816	+1.73495	-213	-369
19 13.8	+47.02	+ 71 33.5	+42 30 13	+0.67215	0.73839	+0.91029	-315	-287
15 54.1	+79.82	+121 28.4	+40 49 04.6	+0.65031	0.75800	+0.85792	-323	-277
1 40.0	-16.43	- 25 00.5	+60 13.4	+0.86432	0.49788	+1.73600	-212	-369
9 22.5	-92.40	-140 37.4	+36 21 54	+0.58964	0.80621	+0.73137	-344	-252
0 21.0	- 3.45	- 5 15.4	+50 11 30	+0.76458	0.64152	+1.19182	-274	-326
9 02.7	-89.15	-135 40.4	+34 40 33.6	+0.56578	0.82336	+0.68716	-351	-241
18 54.2	+50.24	+ 76 27.1	+42 29 18	+0.67197	0.73859	+0.90980	-315	-287
23 50.8	+ 1.52	+ 2 18.4	+53 14 11	+0.79746	0.59982	+1.32950	-256	-340
0 40.5	- 6.65	- 10 07.2	+54 20 32	+0.80885	0.58424	+1.38444	-249	-345
18 53.5	+50.36	+ 76 38	+44 15	+0.69425	0.71749	+0.96761	-306	-296
1 55.3	-18.94	- 28 49	- 2 16	-0.03930	0.99949	-0.03932	-426	+ 17
23 51.4	+ 1.41	+ 2 08.8	+52 05 40	+0.78537	0.61565	+1.27567	-263	-335
0 08.8	- 1.44	- 2 11.8	+47 22 48	+0.73227	0.67838	+1.07942	-289	-312
0 20.3	- 3.34	- 5 04.6	+52 14 03	+0.78686	0.61373	+1.28210	-262	-336
18 45.8	+51.62	+ 78 33.7	+42 59 25.5	+0.67838	0.73264	+0.92594	-313	-289
18 56.3	+49.88	+ 75 54.9	+45 23 45	+0.70840	0.70341	+1.00710	-300	-302

If the horizontal parallax, $\pi = 8''.80/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha = \frac{1}{\sin \delta} \pi \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h = \theta - \alpha$ and θ = sidereal time at 0^h + sidereal equivalent of U.T. - λ

Otherwise add $\Delta X = \Delta x \cos \theta$, $\Delta Y = \Delta y \sin \theta$, ΔZ to solar coordinates to eliminate parallax.

Place	Description	Altitude	Longitude
		m	h m s
Palo Alto, California . . .	Stanford Research Institute	168	+ 8 08 42.3
Penticton, British Columbia .	Dominion Radio Astrophysical Observatory	550	+ 7 58 28.53
Portage Lake, Michigan . . .	Radio Astronomy Obs., Univ. of Michigan	345	+ 5 35 44.5
Potsdam, Germany	Astrophysical Obs., German Acad. of Sciences	35	- 0 52 32.8
Pulkovo, R. S. F. S. R. . . .	Astronomical Obs., Acad. of Sciences	70	- 2 01 17.47
Richmond Hill, Ontario . . .	Radio Observatory, University of Toronto	244	+ 5 17 41.0
Riverside, Maryland	Maryland Point Obs., Naval Research Lab.	30	+ 5 08 55.83
Saint Michel, France	National Center of Scientific Research	614	- 0 22 50
South Gloucester, Ontario . .	Goth Hill Obs., Nat. Research Coun. of Canada	122	+ 5 02 20.67
Stanford, California	Radio Astronomy Institute., Stanford Univ.	80	+ 8 08 45.2
Sydney, New South Wales . . .	Dapto Field Station, Government Observatory	8	-10 03 02.0
Sydney, New South Wales . . .	Parkes Field Station, Government Obs.	315	- 9 53 03.33
Tokyo, Japan	Tokyo Astronomical Observatory at Mitaka	70	- 9 18 09.6
Tortosa, Spain	Observatory of Ebro	53	- 0 01 58
Toyokawa, Japan	Toyokawa Observatory, Nagoya University	16	- 9 09 29.2
Tübingen, Germany	Astronomical Institute of Tübingen Univ.	470	- 0 36 13.5
Tyngsboro, Massachusetts . .	Haystack Site, Lincoln Laboratory	145	+ 4 45 57.20
University, Alabama	Observatory, University of Alabama	87	+ 5 50 10.2
Washington, D.C.	Radio Astronomy Obs., Naval Research Lab.	30	+ 5 08 06.45
Westford, Massachusetts . . .	Millstone Radar, Lincoln Laboratory	156	+ 4 45 57.93

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δ_{xy}	ΔZ
h m	s	° '	° ' "					
15 51.3	+80.28	+122 10.6	+37 24 15	+0.60412	0.79538	+0.75953	-339	-258
16 01.5	+78.60	+119 37.1	+49 19 16	+0.75480	0.65314	+1.15565	-279	-322
18 24.3	+55.15	+ 83 56.1	+42 23 52.5	+0.67081	0.73965	+0.90692	-316	-286
0 52.5	- 8.63	- 13 08.2	+52 17 06.3	+0.78741	0.61303	+1.28446	-262	-336
2 01.3	-19.92	- 30 19.4	+59 46 05.5	+0.86036	0.50477	+1.70444	-215	-367
18 42.3	+52.19	+ 79 25.2	+43 51 44	+0.68941	0.72220	+0.95459	-308	-294
18 51.1	+50.75	+ 77 14.0	+38 22 26.1	+0.61742	0.78500	+0.78652	-335	-263
0 22.8	- 3.75	- 5 42.5	+43 55	+0.69013	0.72159	+0.95641	-308	-294
18 57.7	+49.67	+ 75 35.2	+45 17 45.7	+0.70719	0.70466	+1.00359	-301	-302
15 51.2	+80.29	+122 11.3	+37 23.9	+0.60403	0.79543	+0.75937	-339	-258
10 03.0	-99.06	-150 45.5	-34 28.3	-0.56280	0.82530	-0.68194	-352	+240
9 53.1	-97.42	-148 15.8	-32 59 55	-0.54153	0.83956	-0.64501	-358	+231
9 18.2	-91.69	-139 32.4	+35 40 18.2	+0.57989	0.81331	+0.71300	-347	-247
0 02.0	- 0.32	- 0 29.5	+40 49.2	+0.65023	0.75786	+0.85798	-323	-277
9 09.5	-90.27	-137 22.3	+34 50 06	+0.56800	0.82170	+0.69125	-351	-242
0 36.2	- 5.95	- 9 03.4	+48 32 20	+0.74583	0.66342	+1.12423	-283	-318
19 14.0	+46.97	+ 71 29.3	+42 37 23	+0.67367	0.73698	+0.91410	-314	-287
18 09.8	+57.52	+ 87 32.6	+33 12 33	+0.54457	0.83753	+0.65021	-357	-232
18 51.9	+50.61	+ 77 01.6	+38 49 16.6	+0.62351	0.78014	+0.79922	-333	-266
19 14.0	+46.98	+ 71 29.5	+42 37 02.4	+0.67360	0.73705	+0.91392	-314	-287

If the horizontal parallax, $\pi=8''.80/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha = \pi \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h = \theta - \alpha$ and θ = sidereal time at 0h + sidereal equivalent of U.T. - λ

Otherwise add $\Delta X = \Delta_{xy} \cos \theta$ $\Delta Y = \Delta_{xy} \sin \theta$, ΔZ to solar coordinates to eliminate parallax.

INDEX LIST

Actual names of observatories are in bold type.
Names of owners of private observatories are in italics.
Radio observatories are designated by R.

Name, Etc.	Place
Abo	Turku
Agassiz Station	Harvard
Agnes Scott College	Decatur
Alabama, Univ. of	University
Alaska, Univ. of, R.	College
Allegheny	Pittsburgh
American Univ.	Beirut
Archenhold	Berlin-Treptow
Archiepiscopal Haynald	Kalocsa
Arizona, Univ. of	Tucson
Baden	Heidelberg
Batavia	Jakarta
Belgian Royal, R.	Humain
Bergedorf	Hamburg
Beverly-Begg	Dunedin
Bloomington (Branch)	Brooklyn
Bonn University (Branch), R.	Eschweiler
Bonn University (Branch)	Hoher List
Bosscha	Lembang
Bouzaréah	Algiers
Bowdoin College	Brunswick
Boyden Station	Bloemfontein
Brackett	Claremont
Bradley	Decatur
Brera	Milan
Breslau	Wroclaw
Brown University	Providence
Brussels	Uccle
Cajigal	Caracas
California Inst. of Tech., R.	Big Pine
California Inst. of Tech.	Palomar Mt.
California, Univ. of	Berkeley
California, Univ. of, R.	Hat Creek
California, Univ. of	Mount Hamilton
Canterbury, Univ. of, R.	Christchurch
Capodimonte	Naples
Carleton College	Northfield
Carnegie Institution, R.	Derwood
Carnegie Institution	Mount Wilson
Carnegie Institution	Palomar Mt.
Carter	Wellington
Catalina Station	Tucson
<i>Caunter</i>	Billingshurst
Chabot	Oakland
Chalmers Univ. of Tech., R.	Gothenburg
Chamberlin	Denver
Charles University	Prague
Chicago, Univ. of	Williams Bay
Cointe	Liège
Colaba	Bombay
Collurania	Teramo
Colorado, Univ. of, R.	Boulder

Name, Etc.	Place
Colorado, Univ. of	Climax
Columbia University	New York
Copernicus University	Toruń
Cordoba (Branch)	Bosque Alegre
Cornell University, R.	Arecibo
Cornell University	Ithaca
Cornell Univ. (Branch), R.	Newstead
Crimean Astrophysical, R.	Crimea
Crimean Astrophysical	Simeis
Dapto Field Station, R.	Sydney
<i>Darnell</i>	Copenhagen
Dartmouth College	Hanover
David Dunlap	Richmond Hill
Dearborn	Evanston
<i>de Lange</i>	Blaricum
De Pauw University	Greencastle
Dominion	Ottawa
Dominion Astrophysical, R.	Penticton
Dominion Astrophysical	Victoria
Drake University	Des Moines
Dudley	Albany
Dunsink	Dublin
Dyer	Nashville
Earlyburn	Eddleston
Ebro, R.	Tortosa
Eidgenössische Sternwarte	Zürich
Engelhardt	Kazan
Fabra	Barcelona
Feather Ridge, R.	Cedar Rapids
Field Memorial	Williamstown
Flammarion	Juvisy
Floirac	Bordeaux
Florence	Arcetri
Florida, Univ. of, R.	Gainesville
Flower and Cook	Philadelphia
Franklin Institute	Philadelphia
Fraunhofer, R.	Freiburg
Fuertes	Ithaca
Georgetown College	Washington
German Acad. of Sci., R.	Potsdam
Ghana, Univ. of, R.	Achimota
Goethe Link	Brooklyn
Goodsell	Northfield
Gothard	Szombathely
Goth Hill, R.	South Gloucester
Graz, Univ. of	Kanzelhöhe
Griffith	Los Angeles
Haig	Dehra Dun
Harvard College (Branch)	Bloemfontein

INDEX LIST

Actual names of observatories are in bold type.

Names of owners of private observatories are in italics.

Radio observatories are designated by R.

Name, Etc.	Place	Name, Etc.	Place
Harvard College	Cambridge	Manila	Baguio City
Harvard College (Branch), R.	Fort Davis	Maria Mitchell	Nantucket
Harvard College (Branch)	Harvard	Masaryk University	Brno
Haute-Provence	Saint Michel	Mazelspoort	Bloemfontein
Heinrich-Hertz Inst., R.	Berlin-Adlershof	McDonald	Fort Davis
Hendaye	Abbadia	McGill University	Montreal
High Altitude, R.	Boulder	McKim	Greencastle
High Altitude	Climax	McMath-Hulbert	Lake Angelus
		McMillin	Columbus
Illinois, Univ. of, R.	Danville	Melton Memorial	Columbia
Illinois, Univ. of	Urbana	Michigan, Univ. of	Ann Arbor
India, Survey of	Dehra Dun	Michigan, Univ. of (Branch).	Bloemfontein
Indiana, Univ. of	Bloomington	Michigan, Univ. of (Branch).	Lake Angelus
Indiana, Univ. of	Brooklyn	Michigan, Univ. of (Branch).	Portage Lake
International Latitude	Carloforte	<i>Milicevic</i>	Blaca
International Latitude	Gaithersburg	Minnesota, Univ. of	Minneapolis
International Latitude	Jakarta	Mississippi, Univ. of	Oxford
International Latitude	Kitab	Mitaka	Tokyo
International Latitude	Mizusawa	Monte Mario	Rome
International Latitude	Ukiah	Mont Gros	Nice
Iowa, Univ. of	Iowa City	Morrison	Fayette
Jet Propulsion Lab., R.	Goldstone	Mount Cuba	Wilmington
Kapteyn Laboratory	Groningen	Mount Holyoke College	South Hadley
Karl Schwarzschild	Jena	Mount Locke	Fort Davis
<i>Kenskamp</i>	Hardenberg	Mount Stromlo	Canberra
Kirkwood	Bloomington	Mount Stromlo (Field Sta.)	Coonabarabran
Kitt Peak National	Tucson	Mount Valongo	Rio de Janeiro
Königstuhl	Heidelberg	Mullard, R.	Cambridge
Konkoly	Budapest	Mummy Mountain	Scottsdale
Kuffner	Vienna		
Kwasan	Kyoto	Nagoya Univ., R.	Toyokawa
Kyoto Univ., R.	Ikoman	Nat. Bu. of Standards, R.	Boulder
		National Radio, R.	Green Bank
Ladd	Providence	Naval Research Lab., R.	Riverside
Lamont-Hussey	Bloemfontein	Naval Research Lab., R.	Washington
Lawrence College	Appleton	Netherlands Foundation, R.	Dwingeloo
Leander McCormick	Charlottesville	New Brunswick, Univ. of	Fredericton
Lehigh University	South Bethlehem	Nizamiah	Hyderabad
Leuschner	Berkeley	Norman Lockyer	Sidmouth
Lick	Mount Hamilton	Northwestern Univ.	Evanston
Lincoln Laboratory, R.	Tyngsboro	Nuffield, R.	Jodrell Bank
Lincoln Laboratory, R.	Westford		
Link	Brooklyn	Ohio State Univ.	Columbus
London, Univ. of	Mill Hill	Ohio Wesleyan Univ.	Delaware
Longchamp	Marseilles	Oklahoma, Univ. of	Norman
Louisiana, Univ. of	Baton Rouge	Ole Römer	Aarhus
Lowell	Flagstaff	Onsala, R.	Gothenburg
		Oslo, Univ. of	Harestua
Maine, Univ. of	Orono		
Mak	Sneek	Padua, Univ. of	Asiago
Malsch	Karlsruhe	Paris, R.	Nancay
Manchester, Univ. of, R.	Jodrell Bank	Parkes Field Station R.	Sydney
		Pennsylvania, Univ. of	Philadelphia

INDEX LIST

Actual names of observatories are in bold type.
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Radio observatories are designated by R.

Name, Etc.	Place	Name, Etc.	Place
Perkins	Delaware	Tapada	Lisbon
Pino Torinese	Turin	Texas, Univ. of	Fort Davis
Piwnice	Toruń	Tilanus	Amsterdam
Pomona College	Claremont	Tohoku University	Sendai
Purple Mountain	Nanking	Toronto, Univ. of	Richmond Hill
Queen's Univ., R.	Kingston	Toulouse, Univ. of	Pic du Midi
Radcliffe	Pretoria	Underwood	Appleton
<i>Rasmussen</i>	Helsingör	Urania	Copenhagen
Remeis	Bamberg	<i>Urania Lamonia</i>	Faenza
Rensselaer Poly. Inst., R.	Grafton	Ursa	Helsinki
Rensselaer Poly. Inst	Troy	U. S. Naval (Branch)	Flagstaff
Republic (Annexe)	Hartbeespoort	U. S. Naval (Branch)	Richmond
Republic	Johannesburg	U. S. Naval	Washington
Riverview College	Sydney	Uttar Pradesh	Naini Tal
Royal Greenwich	Herstmonceux	Vanderbilt University	Nashville
Rutherford	New York	<i>van der Meulen</i>	Hoorn
Sacramento Peak	Sunspot	<i>van Diggelen</i>	Weesp
Sagamore Hill, R.	Hamilton	<i>van Raalten</i>	Harderwijk
Saltsjöbaden	Stockholm	Van Vleck	Middletown
Sampson Station, R.	Grafton	Vassar College	Poughkeepsie
Sayre	South Bethlehem	<i>Vastenholt</i>	Beverwijk
<i>Schmidt, D.</i>	Bussum	Vatican	Castel Gandolfo
Shattuck	Hanover	<i>Venter</i>	Pretoria
Shirley Bay, R.	Ottawa	Vermilion River, R.	Danville
Smith	Beloit	Vicenza	Asiago
Smith	Geneva	Ville-Marie	Montreal
Smith College	Northampton	Virginia, Univ. of	Charlottesville
Smithsonian (Branch)	Mount Wilson	<i>Walker</i>	Haarlem
Smithsonian	Washington	Warner and Swasey	Cleveland
Sommers-Bausch	Boulder	Washburn	Madison
Sonnenborgh	Utrecht	Washington University	St. Louis
South Carolina, Univ. of	Columbia	Wesleyan University	Middletown
Sproul	Swarthmore	Whitin	Wellesley
Stanford Research Inst., R.	College	<i>Wieth-Knudsen, N. P.</i>	Tisvildeleje
Stanford Research Inst., R.	Palo Alto	Wilhelm Foerster Institute	Berlin
Stefánik	Prague	Williams College	Williamstown
Sternberg Institute	Moscow	Williston	South Hadley
Steward	Tucson	Wisconsin, Univ. of	Madison
Stockert, R.	Eschweiler	Yale University (Branch).	Bethany
Strawbridge Memorial	Haverford	Yale University	New Haven
Swabian	Stuttgart	Yamamoto	Tanakami
		Yerkes	Williams Bay

JULIAN DAY NUMBER

DAYS ELAPSED AT GREENWICH NOON OF JANUARY 0

Julian Calendar					This table gives the Julian Day numbers for January 0 of every leap year from A. D. 1100 to A. D. 1896, and the reductions to be applied to them to obtain the numbers for January 0 of the leap years in other centuries from 1697 B. C. to A. D. 2296, except in the 20th century which is tabulated on the following two pages.					
Subtract		CENTURY YEARS								
102 2700	B. C.	1600	1500	1400						1300
87 6600		1200	1100	1000						900
73 0500		800	700	600						500
58 4400		400	300	200						100
43 8300	0	...	...	...			
43 8300	A. D.	...	0	100						200
29 2200		300	400	500						600
14 6100		700	800	900						1000
0		1100	1200	1300						1400
LEAP YEARS						Gregorian Calendar				
						CENTURY YEARS				
						1500	1600	1700	1800	
						Add 14 6097 for				
						2000		2100	2200	
B. C.	A. D.	212 2832	215 9357	219 5882	223 2407	226 8932	230 5447	*234 1971	*237 8495	
97	4	212 4293	216 0818	219 7343	223 3868	227 0393	230 6908	234 3432	237 9956	
93	8	212 5754	216 2279	219 8804	223 5329	227 1854	230 8369	234 4893	238 1417	
89	12	212 7215	216 3740	220 0265	223 6790	227 3315	230 9830	234 6354	238 2878	
85	16	212 8676	216 5201	220 1726	223 8251	227 4776	231 1291	234 7815	238 4339	
81	20	213 0137	216 6662	220 3187	223 9712	227 6237	231 2752	234 9276	238 5800	
77	24	213 1598	216 8123	220 4648	224 1173	227 7698	231 4213	235 0737	238 7261	
73	28	213 3059	216 9584	220 6109	224 2634	227 9159	231 5674	235 2198	238 8722	
69	32	213 4520	217 1045	220 7570	224 4095	228 0620	231 7135	235 3659	239 0183	
65	36	213 5981	217 2506	220 9031	224 5556	228 2081	231 8596	235 5120	239 1644	
61	40	213 7442	217 3967	221 0492	224 7017	228 3542	232 0057	235 6581	239 3105	
57	44	213 8903	217 5428	221 1953	224 8478	228 5003	232 1518	235 8042	239 4566	
53	48	214 0364	217 6889	221 3414	224 9939	228 6464	232 2979	235 9503	239 6027	
49	52	214 1825	217 8350	221 4875	225 1400	228 7925	232 4440	236 0964	239 7488	
45	56	214 3286	217 9811	221 6336	225 2861	228 9386	232 5901	236 2425	239 8949	
41	60	214 4747	218 1272	221 7797	225 4322	229 0847	232 7362	236 3886	240 0410	
37	64	214 6208	218 2733	221 9258	225 5783	229 2308	232 8823	236 5347	240 1871	
33	68	214 7669	218 4194	222 0719	225 7244	229 3769	233 0284	236 6808	240 3332	
29	72	214 9130	218 5655	222 2180	225 8705	229 5230	233 1745	236 8269	240 4793	
25	76	215 0591	218 7116	222 3641	226 0166	229 6691	233 3206	236 9730	240 6254	
21	80	215 2052	218 8577	222 5102	226 1627	229 8152	233 4667	237 1191	240 7715	
17	84	215 3513	219 0038	222 6563	226 3088	Gregorian 229 9603	233 6128	237 2652	240 9176	
13	88	215 4974	219 1499	222 8024	226 4549	230 1064	233 7589	237 4113	241 0637	
9	92	215 6435	219 2960	222 9485	226 6010	230 2525	233 9050	237 5574	241 2098	
5	96	215 7896	219 4421	223 0946	226 7471	230 3986	234 0511	237 7035	241 3559	
1	—	215 9357	219 5882	223 2407	226 8932					

*For Jan. —1: these century years are not leap years.

*For Jan. —1; these century years are not leap years.

In the following table, for dates from 1582 October 15 to 1583 December 31 inclusive, Gregorian calendar, *diminish all numbers by 10*.

In century years of the Gregorian calendar that are not leap years, for *January 0* use the number 1 instead of the tabular value 0, and for *February 0* use 32 instead of 31.

YEARS AFTER LEAP YEAR**	MONTHS											
	Add to January 0 of leap year											
	Jan. 0	Feb. 0	Mar. 0	Apr. 0	May 0	June 0	July 0	Aug. 0	Sept. 0	Oct. 0	Nov. 0	Dec. 0
0	0	31	60	91	121	152	182	213	244	274	305	335
1	366	397	425	456	486	517	547	578	609	639	670	700
2	731	762	790	821	851	882	912	943	974	1004	1035	1065
3	1096	1127	1155	1186	1216	1247	1277	1308	1339	1369	1400	1430

**Reckoned from successive leap years, always in the direction of increasing J. D. Number.

TABLE I

JULIAN DAY NUMBER

DAYS ELAPSED AT GREENWICH NOON, A. D. 1900-1950

Year	Jan. 0	Feb. 0	Mar. 0	Apr. 0	May 0	June 0	July 0	Aug. 0	Sept. 0	Oct. 0	Nov. 0	Dec. 0
1900	241 5020	5051	5079	5110	5140	5171	5201	5232	5263	5293	5324	5354
1901	5385	5416	5444	5475	5505	5536	5566	5597	5628	5658	5689	5719
1902	5750	5781	5809	5840	5870	5901	5931	5962	5993	6023	6054	6084
1903	6115	6146	6174	6205	6235	6266	6296	6327	6358	6388	6419	6449
1904	6480	6511	6540	6571	6601	6632	6662	6693	6724	6754	6785	6815
1905	241 6846	6877	6905	6936	6966	6997	7027	7058	7089	7119	7150	7180
1906	7211	7242	7270	7301	7331	7362	7392	7423	7454	7484	7515	7545
1907	7576	7607	7635	7666	7696	7727	7757	7788	7819	7849	7880	7910
1908	7941	7972	8001	8032	8062	8093	8123	8154	8185	8215	8246	8276
1909	8307	8338	8366	8397	8427	8458	8488	8519	8550	8580	8611	8641
1910	241 8672	8703	8731	8762	8792	8823	8853	8884	8915	8945	8976	9006
1911	9037	9068	9096	9127	9157	9188	9218	9249	9280	9310	9341	9371
1912	9402	9433	9462	9493	9523	9554	9584	9615	9646	9676	9707	9737
1913	9768	9799	9827	9858	9888	9919	9949	9980	*0011	*0041	*0072	*0102
1914	242 0133	0164	0192	0223	0253	0284	0314	0345	0376	0406	0437	0467
1915	242 0498	0529	0557	0588	0618	0649	0679	0710	0741	0771	0802	0832
1916	0863	0894	0923	0954	0984	1015	1045	1076	1107	1137	1168	1198
1917	1229	1260	1288	1319	1349	1380	1410	1441	1472	1502	1533	1563
1918	1594	1625	1653	1684	1714	1745	1775	1806	1837	1867	1898	1928
1919	1959	1990	2018	2049	2079	2110	2140	2171	2202	2232	2263	2293
1920	242 2324	2355	2384	2415	2445	2476	2506	2537	2568	2598	2629	2659
1921	2690	2721	2749	2780	2810	2841	2871	2902	2933	2963	2994	3024
1922	3055	3086	3114	3145	3175	3206	3236	3267	3298	3328	3359	3389
1923	3420	3451	3479	3510	3540	3571	3601	3632	3663	3693	3724	3754
1924	3785	3816	3845	3876	3906	3937	3967	3998	4029	4059	4090	4120
1925	242 4151	4182	4210	4241	4271	4302	4332	4363	4394	4424	4455	4485
1926	4516	4547	4575	4606	4636	4667	4697	4728	4759	4789	4820	4850
1927	4881	4912	4940	4971	5001	5032	5062	5093	5124	5154	5185	5215
1928	5246	5277	5306	5337	5367	5398	5428	5459	5490	5520	5551	5581
1929	5612	5643	5671	5702	5732	5763	5793	5824	5855	5885	5916	5946
1930	242 5977	6008	6036	6067	6097	6128	6158	6189	6220	6250	6281	6311
1931	6342	6373	6401	6432	6462	6493	6523	6554	6585	6615	6646	6676
1932	6707	6738	6767	6798	6828	6859	6889	6920	6951	6981	7012	7042
1933	7073	7104	7132	7163	7193	7224	7254	7285	7316	7346	7377	7407
1934	7438	7469	7497	7528	7558	7589	7619	7650	7681	7711	7742	7772
1935	242 7803	7834	7862	7893	7923	7954	7984	8015	8046	8076	8107	8137
1936	8168	8199	8228	8259	8289	8320	8350	8381	8412	8442	8473	8503
1937	8534	8565	8593	8624	8654	8685	8715	8746	8777	8807	8838	8868
1938	8899	8930	8958	8989	9019	9050	9080	9111	9142	9172	9203	9233
1939	9264	9295	9323	9354	9384	9415	9445	9476	9507	9537	9568	9598
1940	242 9629	9660	9689	9720	9750	9781	9811	9842	9873	9903	9934	9964
1941	9995	*0026	*0054	*0085	*0115	*0146	*0176	*0207	*0238	*0268	*0299	*0329
1942	243 0360	0391	0419	0450	0480	0511	0541	0572	0603	0633	0664	0694
1943	0725	0756	0784	0815	0845	0876	0906	0937	0968	0998	1029	1059
1944	1090	1121	1150	1181	1211	1242	1272	1303	1334	1364	1395	1425
1945	243 1456	1487	1515	1546	1576	1607	1637	1668	1699	1729	1760	1790
1946	1821	1852	1880	1911	1941	1972	2002	2033	2064	2094	2125	2155
1947	2186	2217	2245	2276	2306	2337	2367	2398	2429	2459	2490	2520
1948	2551	2582	2611	2642	2672	2703	2733	2764	2795	2825	2856	2886
1949	2917	2948	2976	3007	3037	3068	3098	3129	3160	3190	3221	3251
1950	243 3282	3313	3341	3372	3402	3433	3463	3494	3525	3555	3586	3616

JULIAN DAY NUMBER

DAYS ELAPSED AT GREENWICH NOON, A. D. 1950-2000

Year	Jan. 0	Feb. 0	Mar. 0	Apr. 0	May 0	June 0	July 0	Aug. 0	Sept. 0	Oct. 0	Nov. 0	Dec. 0
1950	243 3282	3313	3341	3372	3402	3433	3463	3494	3525	3555	3586	3616
1951	3647	3678	3706	3737	3767	3798	3828	3859	3890	3920	3951	3981
1952	4012	4043	4072	4103	4133	4164	4194	4225	4256	4286	4317	4347
1953	4378	4409	4437	4468	4498	4529	4559	4590	4621	4651	4682	4712
1954	4743	4774	4802	4833	4863	4894	4924	4955	4986	5016	5047	5077
1955	243 5108	5139	5167	5198	5228	5259	5289	5320	5351	5381	5412	5442
1956	5473	5504	5533	5564	5594	5625	5655	5686	5717	5747	5778	5808
1957	5839	5870	5898	5929	5959	5990	6020	6051	6082	6112	6143	6173
1958	6204	6235	6263	6294	6324	6355	6385	6416	6447	6477	6508	6538
1959	6569	6600	6628	6659	6689	6720	6750	6781	6812	6842	6873	6903
1960	243 6934	6965	6994	7025	7055	7086	7116	7147	7178	7208	7239	7269
1961	7300	7331	7359	7390	7420	7451	7481	7512	7543	7573	7604	7634
1962	7665	7696	7724	7755	7785	7816	7846	7877	7908	7938	7969	7999
1963	8030	8061	8089	8120	8150	8181	8211	8242	8273	8303	8334	8364
1964	8395	8426	8455	8486	8516	8547	8577	8608	8639	8669	8700	8730
1965	243 8761	8792	8820	8851	8881	8912	8942	8973	9004	9034	9065	9095
1966	9126	9157	9185	9216	9246	9277	9307	9338	9369	9399	9430	9460
1967	9491	9522	9550	9581	9611	9642	9672	9703	9734	9764	9795	9825
1968	9856	9887	9916	9947	9977	*0008	*0038	*0069	*0100	*0130	*0161	*0191
1969	244 0222	0253	0281	0312	0342	0373	0403	0434	0465	0495	0526	0556
1970	244 0587	0618	0646	0677	0707	0738	0768	0799	0830	0860	0891	0921
1971	0952	0983	1011	1042	1072	1103	1133	1164	1195	1225	1256	1286
1972	1317	1348	1377	1408	1438	1469	1499	1530	1561	1591	1622	1652
1973	1683	1714	1742	1773	1803	1834	1864	1895	1926	1956	1987	2017
1974	2048	2079	2107	2138	2168	2199	2229	2260	2291	2321	2352	2382
1975	244 2413	2444	2472	2503	2533	2564	2594	2625	2656	2686	2717	2747
1976	2778	2809	2838	2869	2899	2930	2960	2991	3022	3052	3083	3113
1977	3144	3175	3203	3234	3264	3295	3325	3356	3387	3417	3448	3478
1978	3509	3540	3568	3599	3629	3660	3690	3721	3752	3782	3813	3843
1979	3874	3905	3933	3964	3994	4025	4055	4086	4117	4147	4178	4208
1980	244 4239	4270	4299	4330	4360	4391	4421	4452	4483	4513	4544	4574
1981	4605	4636	4664	4695	4725	4756	4786	4817	4848	4878	4909	4939
1982	4970	5001	5029	5060	5090	5121	5151	5182	5213	5243	5274	5304
1983	5335	5366	5394	5425	5455	5486	5516	5547	5578	5608	5639	5669
1984	5700	5731	5760	5791	5821	5852	5882	5913	5944	5974	6005	6035
1985	244 6066	6097	6125	6156	6186	6217	6247	6278	6309	6339	6370	6400
1986	6431	6462	6490	6521	6551	6582	6612	6643	6674	6704	6735	6765
1987	6796	6827	6855	6886	6916	6947	6977	7008	7039	7069	7100	7130
1988	7161	7192	7221	7252	7282	7313	7343	7374	7405	7435	7466	7496
1989	7527	7558	7586	7617	7647	7678	7708	7739	7770	7800	7831	7861
1990	244 7892	7923	7951	7982	8012	8043	8073	8104	8135	8165	8196	8226
1991	8257	8288	8316	8347	8377	8408	8438	8469	8500	8530	8561	8591
1992	8622	8653	8682	8713	8743	8774	8804	8835	8866	8896	8927	8957
1993	8988	9019	9047	9078	9108	9139	9169	9200	9231	9261	9292	9322
1994	9353	9384	9412	9443	9473	9504	9534	9565	9596	9626	9657	9687
1995	244 9718	9749	9777	9808	9838	9869	9899	9930	9961	9991	*0022	*0052
1996	245 0083	0114	0143	0174	0204	0235	0265	0296	0327	0357	0388	0418
1997	0449	0480	0508	0539	0569	0600	0630	0661	0692	0722	0753	0783
1998	0814	0845	0873	0904	0934	0965	0995	1026	1057	1087	1118	1148
1999	1179	1210	1238	1269	1299	1330	1360	1391	1422	1452	1483	1513
2000	245 1544	1575	1604	1635	1665	1696	1726	1757	1788	1818	1849	1879

TABLE II
POLE STAR TABLE, 1967

L.S.T.	0 ^h		1 ^h		2 ^h		3 ^h		4 ^h		5 ^h	
	a ₀	b ₀	a ₀	b ₀	a ₀	b ₀	a ₀	b ₀	a ₀	b ₀	a ₀	b ₀
m	'	'	'	'	'	'	'	'	'	'	'	'
0	-45.9	+27.0	-51.3	+14.0	-53.1	0.0	-51.3	-14.0	-45.9	-27.0	-37.3	-38.0
3	46.2	26.4	51.4	13.3	53.1	- 0.7	51.1	14.7	45.5	27.6	36.8	38.5
6	46.6	25.7	51.6	12.6	53.1	1.4	50.9	15.4	45.1	28.2	36.3	39.0
9	46.9	25.1	51.8	11.9	53.1	2.1	50.7	16.0	44.8	28.8	35.8	39.5
12	47.2	24.5	51.9	11.2	53.0	2.8	50.5	16.7	44.4	29.4	35.3	39.9
15	-47.5	+23.9	-52.1	+10.5	-53.0	- 3.5	-50.2	-17.4	-44.0	-30.0	-34.7	-40.4
18	47.8	23.2	52.2	9.9	52.9	4.2	50.0	18.0	43.6	30.5	34.2	40.9
21	48.1	22.6	52.3	9.2	52.9	4.9	49.8	18.7	43.2	31.1	33.7	41.3
24	48.4	22.0	52.4	8.5	52.8	5.7	49.5	19.4	42.8	31.7	33.1	41.7
27	48.7	21.3	52.5	7.8	52.7	6.4	49.3	20.0	42.4	32.2	32.6	42.2
30	-49.0	+20.7	-52.6	+ 7.1	-52.6	- 7.1	-49.0	-20.7	-42.0	-32.8	-32.0	-42.6
33	49.3	20.0	52.7	6.4	52.5	7.8	48.7	21.3	41.5	33.4	31.5	43.0
36	49.5	19.4	52.8	5.7	52.4	8.5	48.4	22.0	41.1	33.9	30.9	43.4
39	49.8	18.7	52.9	4.9	52.3	9.2	48.1	22.6	40.6	34.4	30.3	43.8
42	50.0	18.0	52.9	4.2	52.2	9.9	47.8	23.2	40.2	35.0	29.7	44.2
45	-50.2	+17.4	-53.0	+ 3.5	-52.1	-10.5	-47.5	-23.9	-39.7	-35.5	-29.2	-44.6
48	50.5	16.7	53.0	2.8	51.9	11.2	47.2	24.5	39.2	36.0	28.6	45.0
51	50.7	16.0	53.1	2.1	51.8	11.9	46.9	25.1	38.8	36.5	28.0	45.3
54	50.9	15.4	53.1	1.4	51.6	12.6	46.6	25.7	38.3	37.0	27.4	45.7
57	51.1	14.7	53.1	+ 0.7	51.4	13.3	46.2	26.4	37.8	37.5	26.8	46.1
60	-51.3	+14.0	-53.1	0.0	-51.3	-14.0	-45.9	-27.0	-37.3	-38.0	-26.2	-46.4
Lat.	a ₁	b ₁	a ₁	b ₁	a ₁	b ₁	a ₁	b ₁	a ₁	b ₁	a ₁	b ₁
°	'	'	'	'	'	'	'	'	'	'	'	'
0	-1	-3	0	-1	0	+1	-1	+3	-2	+5	-3	+5
10	-1	-3	0	-1	0	+1	-1	+3	-2	+4	-3	+4
20	0	-2	0	-1	0	+1	0	+2	-1	+3	-2	+3
30	0	-2	0	-1	0	+1	0	+2	-1	+2	-2	+2
40	0	-1	0	0	0	0	0	+1	-1	+1	-1	+1
45	0	-1	0	0	0	0	0	+1	0	+1	0	+1
50	0	0	0	0	0	0	0	0	0	0	0	0
55	0	+1	0	0	0	0	0	-1	0	-1	+1	-1
60	0	+2	0	+1	0	-1	0	-2	+1	-2	+1	-2
62	0	+2	0	+1	0	-1	0	-2	+1	-3	+2	-3
64	+1	+2	0	+1	0	-1	+1	-2	+1	-3	+2	-3
66	+1	+3	0	+1	0	-1	+1	-3	+2	-4	+3	-4
Month	a ₂	b ₂	a ₂	b ₂	a ₂	b ₂	a ₂	b ₂	a ₂	b ₂	a ₂	b ₂
	'	'	'	'	'	'	'	'	'	'	'	'
Jan.	+2	+1	+2	+1	+1	+1	+1	+2	0	+2	0	+2
Feb.	+1	-1	+1	0	+1	0	+1	0	+1	+1	+1	+1
Mar.	0	-1	0	-1	+1	-1	+1	-1	+1	-1	+1	-1
Apr.	-2	-1	-1	-2	-1	-2	0	-2	0	-2	+1	-2
May	-3	0	-2	-1	-2	-2	-2	-2	-1	-3	0	-3
June	-3	+1	-3	0	-3	-1	-3	-2	-2	-2	-2	-3
July	-3	+3	-3	+2	-4	+1	-4	0	-4	-1	-3	-2
Aug.	-1	+4	-2	+3	-3	+3	-4	+2	-4	+1	-4	0
Sept.	0	+5	-1	+4	-2	+4	-3	+3	-4	+2	-4	+1
Oct.	+2	+5	+1	+5	0	+5	-2	+5	-3	+4	-4	+3
Nov.	+4	+4	+3	+5	+2	+5	0	+6	-1	+5	-3	+5
Dec.	+5	+3	+4	+4	+3	+5	+2	+6	0	+6	-1	+6

Latitude of observer is sum of corrected observed altitude of Polaris and (a₀+a₁+a₂).
Azimuth of Polaris is product of (b₀+b₁+b₂) by secant of latitude.

TABLE II
POLE STAR TABLE, 1967

L.S.T.	6 ^h		7 ^h		8 ^h		9 ^h		10 ^h		11 ^h	
	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀
m												
0	-26.2	-46.4	-13.3	-51.5	+ 0.5	-53.1	+14.2	-51.1	+26.9	-45.6	+37.8	-37.1
3	25.6	46.7	12.6	51.7	1.2	53.1	14.9	50.9	27.5	45.2	38.3	36.6
6	25.0	47.1	11.9	51.9	1.9	53.1	15.5	50.6	28.1	44.8	38.7	36.1
9	24.3	47.4	11.3	52.0	2.6	53.0	16.2	50.4	28.7	44.5	39.2	35.6
12	23.7	47.7	10.6	52.1	3.3	53.0	16.9	50.2	29.3	44.1	39.7	35.0
15	-23.1	-48.0	- 9.9	-52.3	+ 4.0	-52.9	+17.5	-50.0	+29.8	-43.7	+40.1	-34.5
18	22.5	48.3	9.2	52.4	4.7	52.9	18.2	49.7	30.4	43.3	40.6	34.0
21	21.8	48.6	8.5	52.5	5.3	52.8	18.8	49.5	31.0	42.9	41.0	33.5
24	21.2	48.9	7.8	52.6	6.0	52.7	19.5	49.2	31.5	42.5	41.5	32.9
27	20.5	49.1	7.1	52.7	6.7	52.6	20.1	49.0	32.1	42.1	41.9	32.4
30	-19.9	-49.4	- 6.5	-52.8	+ 7.4	-52.5	+20.7	-48.7	+32.6	-41.7	+42.3	-31.9
33	19.3	49.7	5.8	52.8	8.1	52.4	21.4	48.4	33.2	41.2	42.7	31.3
36	18.6	49.9	5.1	52.9	8.8	52.3	22.0	48.1	33.7	40.8	43.1	30.7
39	17.9	50.1	4.4	53.0	9.5	52.2	22.6	47.8	34.2	40.3	43.5	30.2
42	17.3	50.4	3.7	53.0	10.1	52.0	23.3	47.5	34.8	39.9	43.9	29.6
45	-16.6	-50.6	- 3.0	-53.0	+10.8	-51.9	+23.9	-47.2	+35.3	-39.4	+44.3	-29.0
48	16.0	50.8	2.3	53.1	11.5	51.7	24.5	46.9	35.8	39.0	44.7	28.5
51	15.3	51.0	1.6	53.1	12.2	51.6	25.1	46.6	36.3	38.5	45.0	27.9
54	14.6	51.2	0.9	53.1	12.9	51.4	25.7	46.3	36.8	38.0	45.4	27.3
57	14.0	51.4	- 0.2	53.1	13.5	51.2	26.3	45.9	37.3	37.5	45.8	26.7
60	-13.3	-51.5	+ 0.5	-53.1	+14.2	-51.1	+26.9	-45.6	+37.8	-37.1	+46.1	-26.1
Lat.	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁
°												
0	- .4	+ .3	- .5	+ .1	- .5	- .1	- .4	- .3	- .3	- .5	- .2	- .5
10	- .4	+ .3	- .4	+ .1	- .4	- .1	- .4	- .3	- .3	- .4	- .2	- .4
20	- .3	+ .2	- .3	+ .1	- .3	- .1	- .3	- .2	- .2	- .3	- .1	- .3
30	- .2	+ .2	- .2	+ .1	- .2	- .1	- .2	- .2	- .2	- .2	- .1	- .2
40	- .1	+ .1	- .1	.0	- .1	.0	- .1	- .1	- .1	- .1	- .1	- .1
45	- .1	+ .1	- .1	.0	- .1	.0	- .1	- .1	.0	- .1	.0	- .1
50	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
55	+ .1	- .1	+ .1	.0	+ .1	.0	+ .1	+ .1	+ .1	+ .1	.0	+ .1
60	+ .2	- .2	+ .2	- .1	+ .2	+ .1	+ .2	+ .2	+ .1	+ .2	+ .1	+ .2
62	+ .2	- .2	+ .3	- .1	+ .3	+ .1	+ .2	+ .2	+ .2	+ .3	+ .1	+ .3
64	+ .3	- .2	+ .3	- .1	+ .3	+ .1	+ .3	+ .2	+ .2	+ .3	+ .1	+ .3
66	+ .4	- .3	+ .4	- .1	+ .4	+ .1	+ .4	+ .3	+ .3	+ .4	+ .2	+ .4
Month	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂
Jan.	- .1	+ .2	- .1	+ .2	- .1	+ .1	- .2	+ .1	- .2	.0	- .2	.0
Feb.	+ .1	+ .1	.0	+ .1	.0	+ .1	.0	+ .1	- .1	+ .1	- .1	+ .1
Mar.	+ .1	.0	+ .1	.0	+ .1	+ .1	+ .1	+ .1	+ .1	+ .1	+ .1	+ .1
Apr.	+ .1	- .2	+ .2	- .1	+ .2	- .1	+ .2	.0	+ .2	.0	+ .2	+ .1
May	.0	- .3	+ .1	- .2	+ .2	- .2	+ .2	- .2	+ .3	- .1	+ .3	.0
June	- .1	- .3	.0	- .3	+ .1	- .3	+ .2	- .3	+ .2	- .2	+ .3	- .2
July	- .3	- .3	- .2	- .3	- .1	- .4	.0	- .4	+ .1	- .4	+ .2	- .3
Aug.	- .4	- .1	- .3	- .2	- .3	- .3	- .2	- .4	- .1	- .4	.0	- .4
Sept.	- .5	.0	- .4	- .1	- .4	- .2	- .3	- .3	- .2	- .4	- .1	- .4
Oct.	- .5	+ .2	- .5	+ .1	- .5	.0	- .5	- .2	- .4	- .3	- .3	- .4
Nov.	- .4	+ .4	- .5	+ .3	- .5	+ .2	- .6	.0	- .5	- .1	- .5	- .3
Dec.	- .3	+ .5	- .4	+ .4	- .5	+ .3	- .6	+ .2	- .6	.0	- .6	- .1

Latitude of observer is sum of corrected observed altitude of Polaris and (*a*₀+*a*₁+*a*₂).
Azimuth of Polaris is product of (*b*₀+*b*₁+*b*₂) by secant of latitude.

TABLE II
POLE STAR TABLE, 1967

L.S.T.	12 ^h		13 ^h		14 ^h		15 ^h		16 ^h		17 ^h	
	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀
m	′	′	′	′	′	′	′	′	′	′	′	′
0	+46.1	-26.1	+51.3	-13.5	+53.1	0.0	+51.3	+13.5	+46.1	+26.1	+37.8	+37.1
3	46.4	25.5	51.5	12.8	53.1	+ 0.7	51.1	14.2	45.8	26.7	37.3	37.5
6	46.8	24.9	51.7	12.2	53.1	1.4	50.9	14.8	45.4	27.3	36.8	38.0
9	47.1	24.3	51.8	11.5	53.1	2.0	50.8	15.5	45.0	27.9	36.3	38.5
12	47.4	23.7	52.0	10.8	53.0	2.7	50.5	16.1	44.7	28.5	35.8	39.0
15	+47.7	-23.1	+52.1	-10.2	+53.0	+ 3.4	+50.3	+16.8	+44.3	+29.0	+35.3	+39.4
18	48.0	22.5	52.2	9.5	52.9	4.1	50.1	17.4	43.9	29.6	34.8	39.9
21	48.3	21.9	52.3	8.8	52.9	4.8	49.9	18.1	43.5	30.2	34.2	40.3
24	48.6	21.2	52.5	8.2	52.8	5.4	49.6	18.7	43.1	30.7	33.7	40.8
27	48.9	20.6	52.6	7.5	52.7	6.1	49.4	19.3	42.7	31.3	33.2	41.2
30	+49.1	-20.0	+52.7	- 6.8	+52.7	+ 6.8	+49.1	+20.0	+42.3	+31.9	+32.6	+41.7
33	49.4	19.3	52.7	6.1	52.6	7.5	48.9	20.6	41.9	32.4	32.1	42.1
36	49.6	18.7	52.8	5.4	52.5	8.2	48.6	21.2	41.5	32.9	31.5	42.5
39	49.9	18.1	52.9	4.8	52.3	8.8	48.3	21.9	41.0	33.5	31.0	42.9
42	50.1	17.4	52.9	4.1	52.2	9.5	48.0	22.5	40.6	34.0	30.4	43.3
45	+50.3	-16.8	+53.0	- 3.4	+52.1	+10.2	+47.7	+23.1	+40.1	+34.5	+29.8	+43.7
48	50.5	16.1	53.0	2.7	52.0	10.8	47.4	23.7	39.7	35.0	29.3	44.1
51	50.8	15.5	53.1	2.0	51.8	11.5	47.1	24.3	39.2	35.6	28.7	44.5
54	50.9	14.8	53.1	1.4	51.7	12.2	46.8	24.9	38.7	36.1	28.1	44.8
57	51.1	14.2	53.1	- 0.7	51.5	12.8	46.4	25.5	38.3	36.6	27.5	45.2
60	+51.3	-13.5	+53.1	0.0	+51.3	+13.5	+46.1	+26.1	+37.8	+37.1	+26.9	+45.6
Lat.	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁
°	′	′	′	′	′	′	′	′	′	′	′	′
0	-1	-3	.0	-1	.0	+1	-1	+3	-2	+5	-3	+5
10	-1	-3	.0	-1	.0	+1	-1	+3	-2	+4	-3	+4
20	.0	-2	.0	-1	.0	+1	.0	+2	-1	+3	-2	+3
30	.0	-2	.0	-1	.0	+1	.0	+2	-1	+2	-2	+2
40	.0	-1	.0	.0	.0	.0	.0	+1	-1	+1	-1	+1
45	.0	-1	.0	.0	.0	.0	.0	+1	.0	+1	.0	+1
50	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
55	.0	+1	.0	.0	.0	.0	.0	-1	.0	-1	+1	-1
60	.0	+2	.0	+1	.0	-1	.0	-2	+1	-2	+1	-2
62	.0	+2	.0	+1	.0	-1	.0	-2	+1	-3	+2	-3
64	+1	+2	.0	+1	.0	-1	+1	-2	+1	-3	+2	-3
66	+1	+3	.0	+1	.0	-1	+1	-3	+2	-4	+3	-4
Month	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂
	′	′	′	′	′	′	′	′	′	′	′	′
Jan.	-2	-1	-2	-1	-1	-1	-1	-2	.0	-2	.0	-2
Feb.	-1	+1	-1	.0	-1	.0	-1	.0	-1	-1	-1	-1
Mar.	.0	+1	.0	+1	-1	+1	-1	+1	-1	+1	-1	+1
Apr.	+2	+1	+1	+2	+1	+2	.0	+2	.0	+2	-1	+2
May	+3	.0	+2	+1	+2	+2	+2	+2	+1	+3	.0	+3
June	+3	-1	+3	.0	+3	+1	+3	+2	+2	+2	+2	+3
July	+3	-3	+3	-2	+4	-1	+4	.0	+4	+1	+3	+2
Aug.	+1	-4	+2	-3	+3	-3	+4	-2	+4	-1	+4	.0
Sept.	.0	-5	+1	-4	+2	-4	+3	-3	+4	-2	+4	-1
Oct.	-2	-5	-1	-5	.0	-5	+2	-5	+3	-4	+4	-3
Nov.	-4	-4	-3	-5	-2	-5	.0	-6	+1	-5	+3	-5
Dec.	-5	-3	-4	-4	-3	-5	-2	-6	.0	-6	+1	-6

Latitude of observer is sum of corrected observed altitude of Polaris and (*a*₀+*a*₁+*a*₂).
Azimuth of Polaris is product of (*b*₀+*b*₁+*b*₂) by secant of latitude.

TABLE II
POLE STAR TABLE, 1967

L.S.T.	18 ^h		19 ^h		20 ^h		21 ^h		22 ^h		23 ^h	
	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀
m												
0	+26.9	+45.6	+14.2	+51.1	+ 0.5	+53.1	-13.3	+51.5	-26.2	+46.4	-37.3	+38.0
3	26.3	45.9	13.5	51.2	- 0.2	53.1	14.0	51.4	26.8	46.1	37.8	37.5
6	25.7	46.3	12.9	51.4	0.9	53.1	14.6	51.2	27.4	45.7	38.3	37.0
9	25.1	46.6	12.2	51.6	1.6	53.1	15.3	51.0	28.0	45.3	38.8	36.5
12	24.5	46.9	11.5	51.7	2.3	53.1	16.0	50.8	28.6	45.0	39.2	36.0
15	+23.9	+47.2	+10.8	+51.9	- 3.0	+53.0	-16.6	+50.6	-29.2	+44.6	-39.7	+35.5
18	23.3	47.5	10.1	52.0	3.7	53.0	17.3	50.4	29.7	44.2	40.2	35.0
21	22.6	47.8	9.5	52.2	4.4	53.0	17.9	50.1	30.3	43.8	40.6	34.4
24	22.0	48.1	8.8	52.3	5.1	52.9	18.6	49.9	30.9	43.4	41.1	33.9
27	21.4	48.4	8.1	52.4	5.8	52.8	19.3	49.7	31.5	43.0	41.5	33.4
30	+20.7	+48.7	+ 7.4	+52.5	- 6.5	+52.8	-19.9	+49.4	-32.0	+42.6	-42.0	+32.8
33	20.1	49.0	6.7	52.6	7.1	52.7	20.5	49.1	32.6	42.2	42.4	32.2
36	19.5	49.2	6.0	52.7	7.8	52.6	21.2	48.9	33.1	41.7	42.8	31.7
39	18.8	49.5	5.3	52.8	8.5	52.5	21.8	48.6	33.7	41.3	43.2	31.1
42	18.2	49.7	4.7	52.9	9.2	52.4	22.5	48.3	34.2	40.9	43.6	30.5
45	+17.5	+50.0	+ 4.0	+52.9	- 9.9	+52.3	-23.1	+48.0	-34.7	+40.4	-44.0	+30.0
48	16.9	50.2	3.3	53.0	10.6	52.1	23.7	47.7	35.3	39.9	44.4	29.4
51	16.2	50.4	2.6	53.0	11.3	52.0	24.3	47.4	35.8	39.5	44.8	28.8
54	15.5	50.6	1.9	53.1	11.9	51.9	25.0	47.1	36.3	39.0	45.1	28.2
57	14.9	50.9	1.2	53.1	12.6	51.7	25.6	46.7	36.8	38.5	45.5	27.6
60	+14.2	+51.1	+ 0.5	+53.1	-13.3	+51.5	-26.2	+46.4	-37.3	+38.0	-45.9	+27.0
Lat.	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁
°												
0	- .4	+ .3	- .5	+ .1	- .5	- .1	- .4	- .3	- .3	- .5	- .2	- .5
10	- .4	+ .3	- .4	+ .1	- .4	- .1	- .4	- .3	- .3	- .4	- .2	- .4
20	- .3	+ .2	- .3	+ .1	- .3	- .1	- .3	- .2	- .2	- .3	- .1	- .3
30	- .2	+ .2	- .2	+ .1	- .2	- .1	- .2	- .2	- .2	- .2	- .1	- .2
40	- .1	+ .1	- .1	.0	- .1	.0	- .1	- .1	- .1	- .1	- .1	- .1
45	- .1	+ .1	- .1	.0	- .1	.0	- .1	- .1	.0	- .1	.0	- .1
50	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
55	+ .1	- .1	+ .1	.0	+ .1	.0	+ .1	+ .1	+ .1	+ .1	.0	+ .1
60	+ .2	- .2	+ .2	- .1	+ .2	+ .1	+ .2	+ .2	+ .1	+ .2	+ .1	+ .2
62	+ .2	- .2	+ .3	- .1	+ .3	+ .1	+ .2	+ .2	+ .2	+ .3	+ .1	+ .3
64	+ .3	- .2	+ .3	- .1	+ .3	+ .1	+ .3	+ .2	+ .2	+ .3	+ .1	+ .3
66	+ .4	- .3	+ .4	- .1	+ .4	+ .1	+ .4	+ .3	+ .3	+ .4	+ .2	+ .4
Month	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂
Jan.	+ .1	- .2	+ .1	- .2	+ .1	- .1	+ .2	- .1	+ .2	.0	+ .2	.0
Feb.	- .1	- .1	.0	- .1	.0	- .1	.0	- .1	+ .1	- .1	+ .1	- .1
Mar.	- .1	.0	- .1	.0	- .1	- .1	- .1	- .1	- .1	- .1	- .1	- .1
Apr.	- .1	+ .2	- .2	+ .1	- .2	+ .1	- .2	.0	- .2	.0	- .2	- .1
May	.0	+ .3	- .1	+ .2	- .2	+ .2	- .2	+ .2	- .3	+ .1	- .3	.0
June	+ .1	+ .3	.0	+ .3	- .1	+ .3	- .2	+ .3	- .2	+ .2	- .3	+ .2
July	+ .3	+ .3	+ .2	+ .3	+ .1	+ .4	.0	+ .4	- .1	+ .4	- .2	+ .3
Aug.	+ .4	+ .1	+ .3	+ .2	+ .3	+ .3	+ .2	+ .4	+ .1	+ .4	.0	+ .4
Sept.	+ .5	.0	+ .4	+ .1	+ .4	+ .2	+ .3	+ .3	+ .2	+ .4	+ .1	+ .4
Oct.	+ .5	- .2	+ .5	- .1	+ .5	.0	+ .5	+ .2	+ .4	+ .3	+ .3	+ .4
Nov.	+ .4	- .4	+ .5	- .3	+ .5	- .2	+ .6	.0	+ .5	+ .1	+ .5	+ .3
Dec.	+ .3	- .5	+ .4	- .4	+ .5	- .3	+ .6	- .2	+ .6	.0	+ .6	+ .1

Latitude of observer is sum of corrected observed altitude of Polaris and (*a*₀+*a*₁+*a*₂).
Azimuth of Polaris is product of (*b*₀+*b*₁+*b*₂) by secant of latitude.

CONSTANTS FOR THE REDUCTION OF THE MEAN PLACES OF STARS
FROM THE EQUINOX OF t_0 TO THAT OF $t=1967.0$

t_0	ζ_0	z	θ	t_0	M	N
	' "	' "	' "		s	s "
1755	+81 22.25	+81 25.81	+70 50.24	1755	+651.18	+283.38 +4250.6
1760	79 27.21	79 30.60	69 09.97	1760	635.83	276.69 4150.3
1765	77 32.16	77 35.40	67 29.70	1765	620.48	270.00 4050.0
1770	75 37.11	75 40.19	65 49.44	1770	605.13	263.32 3949.8
1775	73 42.05	73 44.97	64 09.17	1775	589.78	256.63 3849.5
1780	+71 46.99	+71 49.76	+62 28.91	1780	+574.43	+249.95 +3749.2
1785	69 51.93	69 54.55	60 48.64	1785	559.08	243.26 3648.9
1790	67 56.85	67 59.33	59 08.38	1790	543.73	236.57 3548.6
1795	66 01.78	66 04.12	57 28.12	1795	528.38	229.89 3448.3
1800	64 06.69	64 08.90	55 47.86	1800	513.03	223.20 3348.1
1805	+62 11.61	+62 13.69	+54 07.60	1805	+497.68	+216.52 +3247.8
1810	60 16.52	60 18.47	52 27.35	1810	482.32	209.83 3147.5
1815	58 21.42	58 23.25	50 47.09	1815	466.97	203.15 3047.2
1820	56 26.32	56 28.03	49 06.83	1820	451.62	196.46 2947.0
1825	54 31.21	54 32.81	47 26.58	1825	436.26	189.78 2846.7
1830	+52 36.10	+52 37.58	+45 46.33	1830	+420.91	+183.10 +2746.4
1835	50 40.98	50 42.36	44 06.07	1835	405.55	176.41 2646.2
1840	48 45.86	48 47.14	42 25.82	1840	390.19	169.73 2545.9
1845	46 50.73	46 51.91	40 45.57	1845	374.84	163.04 2445.7
1850	44 55.60	44 56.68	39 05.33	1850	359.48	156.36 2345.4
1855	+43 00.46	+43 01.45	+37 25.08	1855	+344.12	+149.68 +2245.1
1860	41 05.32	41 06.22	35 44.84	1860	328.77	142.99 2144.9
1865	39 10.17	39 10.99	34 04.59	1865	313.41	136.31 2044.6
1870	37 15.02	37 15.76	32 24.35	1870	298.05	129.63 1944.4
1875	35 19.86	35 20.53	30 44.11	1875	282.69	122.94 1844.1
1880	+33 24.69	+33 25.29	+29 03.87	1880	+267.33	+116.26 +1743.9
1885	31 29.53	31 30.06	27 23.63	1885	251.97	109.58 1643.7
1890	29 34.35	29 34.82	25 43.40	1890	236.61	102.89 1543.4
1895	27 39.17	27 39.58	24 03.17	1895	221.25	96.21 1443.2
1900	25 43.99	25 44.34	22 22.93	1900	205.89	89.53 1342.9
1905	+23 48.80	+23 49.10	+20 42.70	1905	+190.53	+ 82.85 +1242.7
1910	21 53.60	21 53.86	19 02.47	1910	175.16	76.17 1142.5
1915	19 58.40	19 58.62	17 22.25	1915	159.80	69.48 1042.3
1920	18 03.20	18 03.37	15 42.02	1920	144.44	62.80 942.0
1925	16 07.99	16 08.13	14 01.80	1925	129.07	56.12 841.8
1930	+14 12.77	+14 12.88	+12 21.58	1930	+113.71	+ 49.44 + 741.6
1935	12 17.55	12 17.63	10 41.36	1935	98.35	42.76 641.4
1940	10 22.32	10 22.38	9 01.14	1940	82.98	36.08 541.1
1945	8 27.09	8 27.13	7 20.92	1945	67.61	29.39 440.9
1950	6 31.85	6 31.87	5 40.71	1950	52.25	22.71 340.7
1955	+ 4 36.61	+ 4 36.62	+ 4 00.50	1955	+ 36.88	+ 16.03 + 240.5
1960	2 41.36	2 41.36	2 20.29	1960	21.51	9.35 140.3
1965	+ 0 46.10	+ 0 46.10	+ 0 40.08	1965	+ 6.15	+ 2.67 + 40.1

APPROXIMATE REDUCTION FROM THE STANDARD EQUINOX OF
1950.0 TO THE TRUE EQUINOX, 1967

δ	$4 \tan \delta$	Date	f	g	G	Date	f	g	G
$^{\circ}$			$^{\circ}$	$'$	$^{\text{h}}$ $^{\text{m}}$		$^{\circ}$	$'$	$^{\text{h}}$ $^{\text{m}}$
0	0.00	Jan. 0	+51.6 ^s	5.61	23 56	June 29	+53.2 ^s	5.78	23 56
1	0.07	10	51.7	5.62	23 56	July 9*	53.3	5.80	23 56
2	0.14	20	51.8	5.63	23 56	19	53.4	5.81	23 56
3	0.21	30*	51.9	5.64	23 56	29	53.5	5.82	23 55
4	0.28	Feb. 9	52.0	5.65	23 56	Aug. 8	53.6	5.83	23 55
5	0.35	19	+52.0	5.66	23 56	18*	+53.7	5.84	23 55
6	0.42	Mar. 1	52.1	5.67	23 55	28	53.8	5.85	23 55
7	0.49	11*	52.2	5.68	23 55	Sept. 7	53.9	5.85	23 55
8	0.56	21	52.3	5.68	23 55	17	53.9	5.86	23 55
9	0.63	31	52.3	5.69	23 55	27*	54.0	5.87	23 55
10	0.71	Apr. 10	+52.4	5.70	23 55	Oct. 7	+54.0	5.88	23 55
11	0.78	20*†	52.5	5.71	23 55	17	54.1	5.88	23 55
12	0.85	30	52.6	5.72	23 56	27	54.2	5.89	23 55
13	0.92	May 10	52.6	5.72	23 56	Nov. 6*	54.3	5.90	23 55
14	1.00	20	52.7	5.73	23 56	16	54.4	5.91	23 55
15	1.07	30*	+52.9	5.75	23 56	26	+54.5	5.92	23 55
16	1.15	June 9	53.0	5.76	23 56	Dec. 6	54.6	5.94	23 55
17	1.22	19	53.1	5.77	23 56	16*	54.7	5.95	23 56
18	1.30	29	53.2	5.78	23 56	26	54.8	5.96	23 55
19	1.38	July 9*	+53.3	5.80	23 56	36	+55.0	5.98	23 55
20	1.46	*40-day ephemeris date							
21	1.54	†400-day date for osculation epoch							
22	1.62								
23	1.70								
24	1.78								
$4 \tan \delta$									
		δ	0'	10'	20'	30'	40'	50'	60'
		$^{\circ}$							
25	1.87	45	4.00	4.02	4.05	4.07	4.09	4.12	4.14
26	1.95	46	4.14	4.17	4.19	4.22	4.24	4.26	4.29
27	2.04	47	4.29	4.31	4.34	4.37	4.39	4.42	4.44
28	2.13	48	4.44	4.47	4.49	4.52	4.55	4.57	4.60
29	2.22	49	4.60	4.63	4.66	4.68	4.71	4.74	4.77
30	2.31	50	4.77	4.80	4.82	4.85	4.88	4.91	4.94
31	2.40	51	4.94	4.97	5.00	5.03	5.06	5.09	5.12
32	2.50	52	5.12	5.15	5.18	5.21	5.24	5.28	5.31
33	2.60	53	5.31	5.34	5.37	5.41	5.44	5.47	5.51
34	2.70	54	5.51	5.54	5.57	5.61	5.64	5.68	5.71
35	2.80	55	5.71	5.75	5.78	5.82	5.86	5.89	5.93
36	2.91	56	5.93	5.97	6.01	6.04	6.08	6.12	6.16
37	3.01	57	6.16	6.20	6.24	6.28	6.32	6.36	6.40
38	3.13	58	6.40	6.44	6.48	6.53	6.57	6.61	6.66
39	3.24	59	6.66	6.70	6.75	6.79	6.84	6.88	6.93
40	3.36	60	6.93	6.97	7.02	7.07	7.12	7.17	7.22
41	3.48	61	7.22	7.27	7.32	7.37	7.42	7.47	7.52
42	3.60	62	7.52	7.58	7.63	7.68	7.74	7.79	7.85
43	3.73	63	7.85	7.91	7.96	8.02	8.08	8.14	8.20
44	3.86	64	8.20	8.26	8.32	8.39	8.45	8.51	8.58
45	4.00	65	8.58	8.64	8.71	8.78	8.85	8.91	8.98

$$\alpha_{\text{Date}} = \alpha_{1950} + f + g \sin (G + \alpha_{1950}) \tan \delta_{1950}$$

$$\delta_{\text{Date}} = \delta_{1950} + g \cos (G + \alpha_{1950})$$

In the formula for α , the last term is to be expressed in seconds of time by multiplying g in minutes of arc by 4, where the factor 4 is applied by using the tabular value of $4 \tan \delta$.

DIFFERENTIAL ABERRATION

For positive declinations, take the signs of b and c (which are always opposite) from the top of the column when the argument $H+\alpha$ is on the left, from the bottom when $H+\alpha$ is on the right. For negative declinations, reverse the signs of b and c .

The signs of a and d (which are always alike) are independent of the sign of δ , and also of whether $H+\alpha$ is on the left or the right.

δ	62°				64°				66°				68°				70°				δ
$H+\alpha$	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	$H+\alpha$
^h 0	-12	0	0	-3	-13	0	0	-2	-14	0	0	-2	-15	0	0	-2	-17	0	0	-2	^h 24
1	12	4	2	3	13	5	2	2	14	5	2	2	15	6	2	2	16	8	2	2	23
2	11	8	4	2	11	9	4	2	12	10	4	2	13	13	4	2	14	15	4	2	22
3	9	11	5	2	9	13	5	2	10	15	6	2	11	18	6	2	12	22	6	1	21
4	6	13	7	1	7	15	7	1	7	18	7	1	8	22	7	1	8	26	7	1	20
5	-3	15	7	-1	-3	17	7	-1	-4	20	8	-1	-4	24	8	-1	-4	29	8	-1	19
6	0	15	8	0	0	18	8	0	0	21	8	0	0	25	8	0	0	31	8	0	18
7	+3	15	7	+1	+3	17	7	+1	+4	20	8	+1	+4	24	8	+1	+4	29	8	+1	17
8	6	13	7	1	7	15	7	1	7	18	7	1	8	22	7	1	8	26	7	1	16
9	9	11	5	2	9	13	5	2	10	15	6	2	11	18	6	2	12	22	6	1	15
10	11	8	4	2	11	9	4	2	12	10	4	2	13	13	4	2	14	15	4	2	14
11	12	4	2	3	13	5	2	2	14	5	2	2	15	6	2	2	16	8	2	2	13
12	+12	0	0	+3	+13	0	0	+2	+14	0	0	+2	+15	0	0	+2	+17	0	0	+2	12
		+	-			+	-			+	-			+	-			+	-		
δ	71°				72°				73°				74°				75°				δ
^h 0	-18	0	0	-2	-18	0	0	-2	-20	0	0	-2	-21	0	0	-2	-22	0	0	-1	^h 24.0
0.5	17	4	1	2	18	5	1	2	19	6	1	2	21	6	1	2	22	7	1	1	23.5
1.0	17	9	2	2	18	10	2	2	19	11	2	2	20	12	2	2	21	14	2	1	23.0
1.5	16	13	3	2	17	15	3	2	18	16	3	2	19	18	3	1	20	21	3	1	22.5
2.0	15	17	4	2	16	19	4	2	17	21	4	1	18	24	4	1	19	27	4	1	22.0
2.5	14	21	5	1	15	23	5	1	15	26	5	1	16	29	5	1	17	33	5	1	21.5
3.0	-12	24	6	-1	-13	27	6	-1	-14	30	6	-1	-15	34	6	-1	-16	39	6	-1	21.0
3.5	11	27	6	1	11	30	6	1	12	34	6	1	13	38	7	1	13	43	7	1	20.5
4.0	9	29	7	1	9	33	7	1	10	37	7	1	10	42	7	1	11	48	7	1	20.0
4.5	7	31	7	-1	7	35	8	-1	8	39	8	-1	8	44	8	-1	8	51	8	-1	19.5
5.0	5	33	8	0	5	37	8	0	5	41	8	0	5	46	8	0	6	53	8	0	19.0
5.5	-2	34	8	0	-2	38	8	0	-3	42	8	0	-3	48	8	0	-3	54	8	0	18.5
6.0	0	34	8	0	0	38	8	0	0	43	8	0	0	48	8	0	0	55	8	0	18.0
6.5	+2	34	8	0	+2	38	8	0	+3	42	8	0	+3	48	8	0	+3	54	8	0	17.5
7.0	5	33	8	0	5	37	8	0	5	41	8	0	5	46	8	0	6	53	8	0	17.0
7.5	7	31	7	+1	7	35	8	+1	8	39	8	+1	8	44	8	+1	8	51	8	+1	16.5
8.0	9	29	7	1	9	33	7	1	10	37	7	1	10	42	7	1	11	48	7	1	16.0
8.5	11	27	6	1	11	30	6	1	12	34	6	1	13	38	7	1	13	43	7	1	15.5
9.0	12	24	6	1	13	27	6	1	14	30	6	1	15	34	6	1	16	39	6	1	15.0
9.5	+14	21	5	+1	+15	23	5	+1	+15	26	5	+1	+16	29	5	+1	+17	33	5	+1	14.5
10.0	15	17	4	2	16	19	4	2	17	21	4	1	18	24	4	1	19	27	4	1	14.0
10.5	16	13	3	2	17	15	3	2	18	16	3	2	19	18	3	1	20	21	3	1	13.5
11.0	17	9	2	2	18	10	2	2	19	11	2	2	20	12	2	2	21	14	2	1	13.0
11.5	17	4	1	2	18	5	1	2	19	6	1	2	21	6	1	2	22	7	1	1	12.5
12.0	+18	0	0	+2	+18	0	0	+2	+20	0	0	+2	+21	0	0	+2	+22	0	0	+1	12.0
		+	-			+	-			+	-			+	-			+	-		

FACTORS FOR COMPUTING GEOCENTRIC COORDINATES

ϕ	S	C	ϕ	S	C
± 0	0.993277	1.000000	± 45	0.994951	1.001685
1	.993278	1.000001	46	.995009 ⁵⁸	1.001744 ⁵⁹
2	.993281	1.000004	47	.995068 ⁵⁹	1.001803 ⁵⁹
3	.993286	1.000009	48	.995126 ⁵⁸	1.001862 ⁵⁹
4	.993294	1.000016	49	.995185 ⁵⁹	1.001920 ⁵⁸
5	0.993303	1.000026	50	0.995242	1.001978
6	.993314	1.000037	51	.995300 ⁵⁸	1.002036 ⁵⁸
7	.993327	1.000050	52	.995357 ⁵⁷	1.002094 ⁵⁸
8	.993342	1.000065	53	.995414 ⁵⁷	1.002151 ⁵⁷
9	.993359	1.000082	54	.995470 ⁵⁶	1.002207 ⁵⁶
10	0.993378	1.000101	55	0.995525	1.002263
11	.993399	1.000122	56	.995580 ⁵⁵	1.002318 ⁵⁵
12	.993422	1.000145	57	.995634 ⁵⁴	1.002373 ⁵⁵
13	.993446	1.000170	58	.995687 ⁵³	1.002426 ⁵³
14	.993473	1.000197	59	.995740 ⁵³	1.002479 ⁵³
15	0.993501	1.000225	60	0.995791	1.002531
16	.993531	1.000255	61	.995841 ⁵⁰	1.002581 ⁵⁰
17	.993563	1.000287	62	.995890 ⁴⁹	1.002631 ⁵⁰
18	.993596	1.000321	63	.995939 ⁴⁹	1.002679 ⁴⁸
19	.993631	1.000356	64	.995985 ⁴⁶	1.002726 ⁴⁷
20	0.993668	1.000393	65	0.996031	1.002772
21	.993706	1.000432	66	.996076 ⁴⁵	1.002817 ⁴⁵
22	.993746	1.000472	67	.996118 ⁴²	1.002860 ⁴³
23	.993787	1.000514	68	.996160 ⁴²	1.002902 ⁴²
24	.993830	1.000557	69	.996200 ⁴⁰	1.002943 ⁴¹
25	0.993874	1.000601	70	0.996239	1.002981
26	.993920	1.000647	71	.996276 ³⁷	1.003019 ³⁸
27	.993966	1.000694	72	.996311 ³⁵	1.003054 ³⁵
28	.994014	1.000742	73	.996345 ³⁴	1.003088 ³⁴
29	.994063	1.000791	74	.996377 ³²	1.003120 ³²
30	0.994113	1.000841	75	0.996407	1.003151
31	.994164	1.000893	76	.996436 ²⁹	1.003180 ²⁹
32	.994216	1.000945	77	.996462 ²⁶	1.003207 ²⁷
33	.994269	1.000999	78	.996487 ²⁵	1.003232 ²⁵
34	.994323	1.001053	79	.996510 ²³	1.003255 ²³
35	0.994378	1.001108	80	0.996531	1.003276
36	.994433	1.001163	81	.996550 ¹⁹	1.003295 ¹⁹
37	.994489	1.001220	82	.996568 ¹⁸	1.003313 ¹⁸
38	.994545	1.001277	83	.996583 ¹⁵	1.003328 ¹⁵
39	.994602	1.001334	84	.996596 ¹³	1.003341 ¹³
40	0.994660	1.001392	85	0.996607	1.003353
41	.994717	1.001450	86	.996617 ¹⁰	1.003362 ⁹
42	.994776	1.001508	87	.996624 ⁷	1.003369 ⁷
43	.994834	1.001567	88	.996629 ⁵	1.003374 ⁵
44	.994892	1.001626	89	.996632 ³	1.003377 ³
± 45	0.994951	1.001685	± 90	0.996633	1.003378

Geocentric Coordinates referred to the International Ellipsoid:

$$\rho \sin \varphi' = (S + H) \sin \varphi,$$

$$\rho \cos \varphi' = (C + H) \cos \varphi;$$

H, the altitude above sea-level in units of the equatorial radius of the Earth, is

$$0.1567794 \times 10^{-6} \times \text{altitude in m, or } 0.0477865 \times 10^{-6} \times \text{altitude in ft.}$$

CONVERSION OF MEAN SIDEREAL INTO MEAN SOLAR TIME

m	0 ^h		1 ^h		2 ^h		3 ^h		4 ^h		5 ^h		6 ^h		7 ^h		SECONDS	
	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	s	s
0	0	00.000	0	09.830	0	19.659	0	29.489	0	39.318	0	49.148	0	58.977	1	08.807	0	0.000
1	0	00.164	0	09.993	0	19.823	0	29.653	0	39.482	0	49.312	0	59.141	1	08.971	1	.003
2	0	00.328	0	10.157	0	19.987	0	29.816	0	39.646	0	49.475	0	59.305	1	09.135	2	.005
3	0	00.491	0	10.321	0	20.151	0	29.980	0	39.810	0	49.639	0	59.469	1	09.298	3	.008
4	0	00.655	0	10.485	0	20.314	0	30.144	0	39.974	0	49.803	0	59.633	1	09.462	4	.011
5	0	00.819	0	10.649	0	20.478	0	30.308	0	40.137	0	49.967	0	59.796	1	09.626	5	0.014
6	0	00.983	0	10.813	0	20.642	0	30.472	0	40.301	0	50.131	0	59.960	1	09.790	6	.016
7	0	01.147	0	10.976	0	20.806	0	30.635	0	40.465	0	50.295	1	00.124	1	09.954	7	.019
8	0	01.311	0	11.140	0	20.970	0	30.799	0	40.629	0	50.458	1	00.288	1	10.118	8	.022
9	0	01.474	0	11.304	0	21.134	0	30.963	0	40.793	0	50.622	1	00.452	1	10.281	9	.025
10	0	01.638	0	11.468	0	21.297	0	31.127	0	40.957	0	50.786	1	00.616	1	10.445	10	0.027
11	0	01.802	0	11.632	0	21.461	0	31.291	0	41.120	0	50.950	1	00.779	1	10.609	11	.030
12	0	01.966	0	11.795	0	21.625	0	31.455	0	41.284	0	51.114	1	00.943	1	10.773	12	.033
13	0	02.130	0	11.959	0	21.789	0	31.618	0	41.448	0	51.278	1	01.107	1	10.937	13	.035
14	0	02.294	0	12.123	0	21.953	0	31.782	0	41.612	0	51.441	1	01.271	1	11.100	14	.038
15	0	02.457	0	12.287	0	22.117	0	31.946	0	41.776	0	51.605	1	01.435	1	11.264	15	0.041
16	0	02.621	0	12.451	0	22.280	0	32.110	0	41.939	0	51.769	1	01.599	1	11.428	16	.044
17	0	02.785	0	12.615	0	22.444	0	32.274	0	42.103	0	51.933	1	01.762	1	11.592	17	.046
18	0	02.949	0	12.778	0	22.608	0	32.438	0	42.267	0	52.097	1	01.926	1	11.756	18	.049
19	0	03.113	0	12.942	0	22.772	0	32.601	0	42.431	0	52.260	1	02.090	1	11.920	19	.052
20	0	03.277	0	13.106	0	22.936	0	32.765	0	42.595	0	52.424	1	02.254	1	12.083	20	0.055
21	0	03.440	0	13.270	0	23.099	0	32.929	0	42.759	0	52.588	1	02.418	1	12.247	21	.057
22	0	03.604	0	13.434	0	23.263	0	33.093	0	42.922	0	52.752	1	02.582	1	12.411	22	.060
23	0	03.768	0	13.598	0	23.427	0	33.257	0	43.086	0	52.916	1	02.745	1	12.575	23	.063
24	0	03.932	0	13.761	0	23.591	0	33.421	0	43.250	0	53.080	1	02.909	1	12.739	24	.066
25	0	04.096	0	13.925	0	23.755	0	33.584	0	43.414	0	53.243	1	03.073	1	12.903	25	0.068
26	0	04.259	0	14.089	0	23.919	0	33.748	0	43.578	0	53.407	1	03.237	1	13.066	26	.071
27	0	04.423	0	14.253	0	24.082	0	33.912	0	43.742	0	53.571	1	03.401	1	13.230	27	.074
28	0	04.587	0	14.417	0	24.246	0	34.076	0	43.905	0	53.735	1	03.564	1	13.394	28	.076
29	0	04.751	0	14.581	0	24.410	0	34.240	0	44.069	0	53.899	1	03.728	1	13.558	29	.079
30	0	04.915	0	14.744	0	24.574	0	34.403	0	44.233	0	54.063	1	03.892	1	13.722	30	0.082
31	0	05.079	0	14.908	0	24.738	0	34.567	0	44.397	0	54.226	1	04.056	1	13.886	31	.085
32	0	05.242	0	15.072	0	24.902	0	34.731	0	44.561	0	54.390	1	04.220	1	14.049	32	.087
33	0	05.406	0	15.236	0	25.065	0	34.895	0	44.725	0	54.554	1	04.384	1	14.213	33	.090
34	0	05.570	0	15.400	0	25.229	0	35.059	0	44.888	0	54.718	1	04.547	1	14.377	34	.093
35	0	05.734	0	15.563	0	25.393	0	35.223	0	45.052	0	54.882	1	04.711	1	14.541	35	0.096
36	0	05.898	0	15.727	0	25.557	0	35.386	0	45.216	0	55.046	1	04.875	1	14.705	36	.098
37	0	06.062	0	15.891	0	25.721	0	35.550	0	45.380	0	55.209	1	05.039	1	14.868	37	.101
38	0	06.225	0	16.055	0	25.885	0	35.714	0	45.544	0	55.373	1	05.203	1	15.032	38	.104
39	0	06.389	0	16.219	0	26.048	0	35.878	0	45.707	0	55.537	1	05.367	1	15.196	39	.106
40	0	06.553	0	16.383	0	26.212	0	36.042	0	45.871	0	55.701	1	05.530	1	15.360	40	0.109
41	0	06.717	0	16.546	0	26.376	0	36.206	0	46.035	0	55.865	1	05.694	1	15.524	41	.112
42	0	06.881	0	16.710	0	26.540	0	36.369	0	46.199	0	56.028	1	05.858	1	15.688	42	.115
43	0	07.045	0	16.874	0	26.704	0	36.533	0	46.363	0	56.192	1	06.022	1	15.851	43	.117
44	0	07.208	0	17.038	0	26.867	0	36.697	0	46.527	0	56.356	1	06.186	1	16.015	44	.120
45	0	07.372	0	17.202	0	27.031	0	36.861	0	46.690	0	56.520	1	06.350	1	16.179	45	0.123
46	0	07.536	0	17.366	0	27.195	0	37.025	0	46.854	0	56.684	1	06.513	1	16.343	46	.126
47	0	07.700	0	17.529	0	27.359	0	37.189	0	47.018	0	56.848	1	06.677	1	16.507	47	.128
48	0	07.864	0	17.693	0	27.523	0	37.352	0	47.182	0	57.011	1	06.841	1	16.671	48	.131
49	0	08.027	0	17.857	0	27.687	0	37.516	0	47.346	0	57.175	1	07.005	1	16.834	49	.134
50	0	08.191	0	18.021	0	27.850	0	37.680	0	47.510	0	57.339	1	07.169	1	16.998	50	0.137
51	0	08.355	0	18.185	0	28.014	0	37.844	0	47.673	0	57.503	1	07.332	1	17.162	51	.139
52	0	08.519	0	18.349	0	28.178	0	38.008	0	47.837	0	57.667	1	07.496	1	17.326	52	.142
53	0	08.683	0	18.512	0	28.342	0	38.171	0	48.001	0	57.831	1	07.660	1	17.490	53	.145
54	0	08.847	0	18.676	0	28.506	0	38.335	0	48.165	0	57.994	1	07.824	1	17.654	54	.147
55	0	09.010	0	18.840	0	28.670	0	38.499	0	48.329	0	58.158	1	07.988	1	17.817	55	0.150
56	0	09.174	0	19.004	0	28.833	0	38.663	0	48.493	0	58.322	1	08.152	1	17.981	56	.153
57	0	09.338	0	19.168	0	28.997	0	38.827	0	48.656	0	58.486	1	08.315	1	18.145	57	.156
58	0	09.502	0	19.331	0	29.161	0	38.991	0	48.820	0	58.650	1	08.479	1	18.309	58	.158
59	0	09.666	0	19.495	0	29.325	0	39.154	0	48.984	0	58.814	1	08.643	1	18.473	59	0.161

Subtract tabular amount from mean sidereal time interval to obtain equivalent mean solar time interval.

CONVERSION OF MEAN SIDEREAL INTO MEAN SOLAR TIME

	8 ^h		9 ^h		10 ^h		11 ^h		12 ^h		13 ^h		14 ^h		15 ^h		SECONDS	
m	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	s	s
0	1	18.636	1	28.466	1	38.296	1	48.125	1	57.955	2	07.784	2	17.614	2	27.443	0	0.000
1	1	18.800	1	28.630	1	38.459	1	48.289	1	58.119	2	07.948	2	17.778	2	27.607	1	.003
2	1	18.964	1	28.794	1	38.623	1	48.453	1	58.282	2	08.112	2	17.942	2	27.771	2	.005
3	1	19.128	1	28.958	1	38.787	1	48.617	1	58.446	2	08.276	2	18.105	2	27.935	3	.008
4	1	19.292	1	29.121	1	38.951	1	48.780	1	58.610	2	08.440	2	18.269	2	28.099	4	.011
5	1	19.456	1	29.285	1	39.115	1	48.944	1	58.774	2	08.603	2	18.433	2	28.263	5	0.014
6	1	19.619	1	29.449	1	39.279	1	49.108	1	58.938	2	08.767	2	18.597	2	28.426	6	.016
7	1	19.783	1	29.613	1	39.442	1	49.272	1	59.102	2	08.931	2	18.761	2	28.590	7	.019
8	1	19.947	1	29.777	1	39.606	1	49.436	1	59.265	2	09.095	2	18.924	2	28.754	8	.022
9	1	20.111	1	29.940	1	39.770	1	49.600	1	59.429	2	09.259	2	19.088	2	28.918	9	.025
10	1	20.275	1	30.104	1	39.934	1	49.763	1	59.593	2	09.423	2	19.252	2	29.082	10	0.027
11	1	20.439	1	30.268	1	40.098	1	49.927	1	59.757	2	09.586	2	19.416	2	29.246	11	.030
12	1	20.602	1	30.432	1	40.262	1	50.091	1	59.921	2	09.750	2	19.580	2	29.409	12	.033
13	1	20.766	1	30.596	1	40.425	1	50.255	2	00.084	2	09.914	2	19.744	2	29.573	13	.035
14	1	20.930	1	30.760	1	40.589	1	50.419	2	00.248	2	10.078	2	19.907	2	29.737	14	.038
15	1	21.094	1	30.923	1	40.753	1	50.583	2	00.412	2	10.242	2	20.071	2	29.901	15	0.041
16	1	21.258	1	31.087	1	40.917	1	50.746	2	00.576	2	10.406	2	20.235	2	30.065	16	.044
17	1	21.422	1	31.251	1	41.081	1	50.910	2	00.740	2	10.569	2	20.399	2	30.228	17	.046
18	1	21.585	1	31.415	1	41.244	1	51.074	2	00.904	2	10.733	2	20.563	2	30.392	18	.049
19	1	21.749	1	31.579	1	41.408	1	51.238	2	01.067	2	10.897	2	20.727	2	30.556	19	.052
20	1	21.913	1	31.743	1	41.572	1	51.402	2	01.231	2	11.061	2	20.890	2	30.720	20	0.055
21	1	22.077	1	31.906	1	41.736	1	51.566	2	01.395	2	11.225	2	21.054	2	30.884	21	.057
22	1	22.241	1	32.070	1	41.900	1	51.729	2	01.559	2	11.388	2	21.218	2	31.048	22	.060
23	1	22.404	1	32.234	1	42.064	1	51.893	2	01.723	2	11.552	2	21.382	2	31.211	23	.063
24	1	22.568	1	32.398	1	42.227	1	52.057	2	01.887	2	11.716	2	21.546	2	31.375	24	.066
25	1	22.732	1	32.562	1	42.391	1	52.221	2	02.050	2	11.880	2	21.710	2	31.539	25	0.068
26	1	22.896	1	32.726	1	42.555	1	52.385	2	02.214	2	12.044	2	21.873	2	31.703	26	.071
27	1	23.060	1	32.889	1	42.719	1	52.548	2	02.378	2	12.208	2	22.037	2	31.867	27	.074
28	1	23.224	1	33.053	1	42.883	1	52.712	2	02.542	2	12.371	2	22.201	2	32.031	28	.076
29	1	23.387	1	33.217	1	43.047	1	52.876	2	02.706	2	12.535	2	22.365	2	32.194	29	.079
30	1	23.551	1	33.381	1	43.210	1	53.040	2	02.870	2	12.699	2	22.529	2	32.358	30	0.082
31	1	23.715	1	33.545	1	43.374	1	53.204	2	03.033	2	12.863	2	22.692	2	32.522	31	.085
32	1	23.879	1	33.708	1	43.538	1	53.368	2	03.197	2	13.027	2	22.856	2	32.686	32	.087
33	1	24.043	1	33.872	1	43.702	1	53.531	2	03.361	2	13.191	2	23.020	2	32.850	33	.090
34	1	24.207	1	34.036	1	43.866	1	53.695	2	03.525	2	13.354	2	23.184	2	33.013	34	.093
35	1	24.370	1	34.200	1	44.030	1	53.859	2	03.689	2	13.518	2	23.348	2	33.177	35	0.096
36	1	24.534	1	34.364	1	44.193	1	54.023	2	03.852	2	13.682	2	23.512	2	33.341	36	.098
37	1	24.698	1	34.528	1	44.357	1	54.187	2	04.016	2	13.846	2	23.675	2	33.505	37	.101
38	1	24.862	1	34.691	1	44.521	1	54.351	2	04.180	2	14.010	2	23.839	2	33.669	38	.104
39	1	25.026	1	34.855	1	44.685	1	54.514	2	04.344	2	14.174	2	24.003	2	33.833	39	.106
40	1	25.190	1	35.019	1	44.849	1	54.678	2	04.508	2	14.337	2	24.167	2	33.996	40	0.109
41	1	25.353	1	35.183	1	45.012	1	54.842	2	04.672	2	14.501	2	24.331	2	34.160	41	.112
42	1	25.517	1	35.347	1	45.176	1	55.006	2	04.835	2	14.665	2	24.495	2	34.324	42	.115
43	1	25.681	1	35.511	1	45.340	1	55.170	2	04.999	2	14.829	2	24.658	2	34.488	43	.117
44	1	25.845	1	35.674	1	45.504	1	55.334	2	05.163	2	14.993	2	24.822	2	34.652	44	.120
45	1	26.009	1	35.838	1	45.668	1	55.497	2	05.327	2	15.156	2	24.986	2	34.816	45	0.123
46	1	26.172	1	36.002	1	45.832	1	55.661	2	05.491	2	15.320	2	25.150	2	34.979	46	.126
47	1	26.336	1	36.166	1	45.995	1	55.825	2	05.655	2	15.484	2	25.314	2	35.143	47	.128
48	1	26.500	1	36.330	1	46.159	1	55.989	2	05.818	2	15.648	2	25.478	2	35.307	48	.131
49	1	26.664	1	36.494	1	46.323	1	56.153	2	05.982	2	15.812	2	25.641	2	35.471	49	.134
50	1	26.828	1	36.657	1	46.487	1	56.316	2	06.146	2	15.976	2	25.805	2	35.635	50	0.137
51	1	26.992	1	36.821	1	46.651	1	56.480	2	06.310	2	16.139	2	25.969	2	35.799	51	.139
52	1	27.155	1	36.985	1	46.815	1	56.644	2	06.474	2	16.303	2	26.133	2	35.962	52	.142
53	1	27.319	1	37.149	1	46.978	1	56.808	2	06.638	2	16.467	2	26.297	2	36.126	53	.145
54	1	27.483	1	37.313	1	47.142	1	56.972	2	06.801	2	16.631	2	26.460	2	36.290	54	.147
55	1	27.647	1	37.476	1	47.306	1	57.136	2	06.965	2	16.795	2	26.624	2	36.454	55	0.150
56	1	27.811	1	37.640	1	47.470	1	57.299	2	07.129	2	16.959	2	26.788	2	36.618	56	.153
57	1	27.975	1	37.804	1	47.634	1	57.463	2	07.293	2	17.122	2	26.952	2	36.781	57	.156
58	1	28.138	1	37.968	1	47.798	1	57.627	2	07.457	2	17.286	2	27.116	2	36.945	58	.158
59	1	28.302	1	38.132	1	47.961	1	57.791	2	07.620	2	17.450	2	27.280	2	37.109	59	0.161

Subtract tabular amount from mean sidereal time interval to obtain equivalent mean solar time interval.

CONVERSION OF MEAN SIDEREAL INTO MEAN SOLAR TIME

m	16 ^h		17 ^h		18 ^h		19 ^h		20 ^h		21 ^h		22 ^h		23 ^h		SECONDS	
	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	s	s
0	2	37.273	2	47.103	2	56.932	3	06.762	3	16.591	3	26.421	3	36.250	3	46.080	0	0.000
1	2	37.437	2	47.266	2	57.096	3	06.925	3	16.755	3	26.585	3	36.414	3	46.244	1	.003
2	2	37.601	2	47.430	2	57.260	3	07.089	3	16.919	3	26.748	3	36.578	3	46.408	2	.005
3	2	37.764	2	47.594	2	57.424	3	07.253	3	17.083	3	26.912	3	36.742	3	46.571	3	.008
4	2	37.928	2	47.758	2	57.587	3	07.417	3	17.247	3	27.076	3	36.906	3	46.735	4	.011
5	2	38.092	2	47.922	2	57.751	3	07.581	3	17.410	3	27.240	3	37.069	3	46.899	5	0.014
6	2	38.256	2	48.085	2	57.915	3	07.745	3	17.574	3	27.404	3	37.233	3	47.063	6	.016
7	2	38.420	2	48.249	2	58.079	3	07.908	3	17.738	3	27.568	3	37.397	3	47.227	7	.019
8	2	38.584	2	48.413	2	58.243	3	08.072	3	17.902	3	27.731	3	37.561	3	47.391	8	.022
9	2	38.747	2	48.577	2	58.407	3	08.236	3	18.066	3	27.895	3	37.725	3	47.554	9	.025
10	2	38.911	2	48.741	2	58.570	3	08.400	3	18.229	3	28.059	3	37.889	3	47.718	10	0.027
11	2	39.075	2	48.905	2	58.734	3	08.564	3	18.393	3	28.223	3	38.052	3	47.882	11	.030
12	2	39.239	2	49.068	2	58.898	3	08.728	3	18.557	3	28.387	3	38.216	3	48.046	12	.033
13	2	39.403	2	49.232	2	59.062	3	08.891	3	18.721	3	28.551	3	38.380	3	48.210	13	.035
14	2	39.567	2	49.396	2	59.226	3	09.055	3	18.885	3	28.714	3	38.544	3	48.373	14	.038
15	2	39.730	2	49.560	2	59.389	3	09.219	3	19.049	3	28.878	3	38.708	3	48.537	15	0.041
16	2	39.894	2	49.724	2	59.553	3	09.383	3	19.212	3	29.042	3	38.872	3	48.701	16	.044
17	2	40.058	2	49.888	2	59.717	3	09.547	3	19.376	3	29.206	3	39.035	3	48.865	17	.046
18	2	40.222	2	50.051	2	59.881	3	09.711	3	19.540	3	29.370	3	39.199	3	49.029	18	.049
19	2	40.386	2	50.215	3	00.045	3	09.874	3	19.704	3	29.533	3	39.363	3	49.193	19	.052
20	2	40.549	2	50.379	3	00.209	3	10.038	3	19.868	3	29.697	3	39.527	3	49.356	20	0.055
21	2	40.713	2	50.543	3	00.372	3	10.202	3	20.032	3	29.861	3	39.691	3	49.520	21	.057
22	2	40.877	2	50.707	3	00.536	3	10.366	3	20.195	3	30.025	3	39.855	3	49.684	22	.060
23	2	41.041	2	50.871	3	00.700	3	10.530	3	20.359	3	30.189	3	40.018	3	49.848	23	.063
24	2	41.205	2	51.034	3	00.864	3	10.693	3	20.523	3	30.353	3	40.182	3	50.012	24	.066
25	2	41.369	2	51.198	3	01.028	3	10.857	3	20.687	3	30.516	3	40.346	3	50.176	25	0.068
26	2	41.532	2	51.362	3	01.192	3	11.021	3	20.851	3	30.680	3	40.510	3	50.339	26	.071
27	2	41.696	2	51.526	3	01.355	3	11.185	3	21.015	3	30.844	3	40.674	3	50.503	27	.074
28	2	41.860	2	51.690	3	01.519	3	11.349	3	21.178	3	31.008	3	40.837	3	50.667	28	.076
29	2	42.024	2	51.853	3	01.683	3	11.513	3	21.342	3	31.172	3	41.001	3	50.831	29	.079
30	2	42.188	2	52.017	3	01.847	3	11.676	3	21.506	3	31.336	3	41.165	3	50.995	30	0.082
31	2	42.352	2	52.181	3	02.011	3	11.840	3	21.670	3	31.499	3	41.329	3	51.159	31	.085
32	2	42.515	2	52.345	3	02.175	3	12.004	3	21.834	3	31.663	3	41.493	3	51.322	32	.087
33	2	42.679	2	52.509	3	02.338	3	12.168	3	21.997	3	31.827	3	41.657	3	51.486	33	.090
34	2	42.843	2	52.673	3	02.502	3	12.332	3	22.161	3	31.991	3	41.820	3	51.650	34	.093
35	2	43.007	2	52.836	3	02.666	3	12.496	3	22.325	3	32.155	3	41.984	3	51.814	35	0.096
36	2	43.171	2	53.000	3	02.830	3	12.659	3	22.489	3	32.319	3	42.148	3	51.978	36	.098
37	2	43.335	2	53.164	3	02.994	3	12.823	3	22.653	3	32.482	3	42.312	3	52.141	37	.101
38	2	43.498	2	53.328	3	03.157	3	12.987	3	22.817	3	32.646	3	42.476	3	52.305	38	.104
39	2	43.662	2	53.492	3	03.321	3	13.151	3	22.980	3	32.810	3	42.640	3	52.469	39	.106
40	2	43.826	2	53.656	3	03.485	3	13.315	3	23.144	3	32.974	3	42.803	3	52.633	40	0.109
41	2	43.990	2	53.819	3	03.649	3	13.479	3	23.308	3	33.138	3	42.967	3	52.797	41	.112
42	2	44.154	2	53.983	3	03.813	3	13.642	3	23.472	3	33.301	3	43.131	3	52.961	42	.115
43	2	44.317	2	54.147	3	03.977	3	13.806	3	23.636	3	33.465	3	43.295	3	53.124	43	.117
44	2	44.481	2	54.311	3	04.140	3	13.970	3	23.800	3	33.629	3	43.459	3	53.288	44	.120
45	2	44.645	2	54.475	3	04.304	3	14.134	3	23.963	3	33.793	3	43.623	3	53.452	45	0.123
46	2	44.809	2	54.639	3	04.468	3	14.298	3	24.127	3	33.957	3	43.786	3	53.616	46	.126
47	2	44.973	2	54.802	3	04.632	3	14.461	3	24.291	3	34.121	3	43.950	3	53.780	47	.129
48	2	45.137	2	54.966	3	04.796	3	14.625	3	24.455	3	34.284	3	44.114	3	53.944	48	.131
49	2	45.300	2	55.130	3	04.960	3	14.789	3	24.619	3	34.448	3	44.278	3	54.107	49	.134
50	2	45.464	2	55.294	3	05.123	3	14.953	3	24.783	3	34.612	3	44.442	3	54.271	50	0.137
51	2	45.628	2	55.458	3	05.287	3	15.117	3	24.946	3	34.776	3	44.605	3	54.435	51	.139
52	2	45.792	2	55.621	3	05.451	3	15.281	3	25.110	3	34.940	3	44.769	3	54.599	52	.142
53	2	45.956	2	55.785	3	05.615	3	15.444	3	25.274	3	35.104	3	44.933	3	54.763	53	.145
54	2	46.120	2	55.949	3	05.779	3	15.608	3	25.438	3	35.267	3	45.097	3	54.927	54	.147
55	2	46.283	2	56.113	3	05.943	3	15.772	3	25.602	3	35.431	3	45.261	3	55.090	55	0.150
56	2	46.447	2	56.277	3	06.106	3	15.936	3	25.765	3	35.595	3	45.425	3	55.254	56	.153
57	2	46.611	2	56.441	3	06.270	3	16.100	3	25.929	3	35.759	3	45.588	3	55.418	57	.156
58	2	46.775	2	56.604	3	06.434	3	16.264	3	26.093	3	35.923	3	45.752	3	55.582	58	.158
59	2	46.939	2	56.768	3	06.598	3	16.427	3	26.257	3	36.087	3	45.916	3	55.746	59	0.161

Subtract tabular amount from mean sidereal time interval to obtain equivalent mean solar time interval.

CONVERSION OF MEAN SOLAR INTO MEAN SIDEREAL TIME

	0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	SECONDS	
m	m s	m s	m s	m s	m s	m s	m s	m s	s	s
0	0 00.000	0 09.856	0 19.713	0 29.569	0 39.426	0 49.282	0 59.139	1 08.995	0	0.000
1	0 00.164	0 10.021	0 19.877	0 29.734	0 39.590	0 49.447	0 59.303	1 09.160	1	.003
2	0 00.329	0 10.185	0 20.041	0 29.898	0 39.754	0 49.611	0 59.467	1 09.324	2	.005
3	0 00.493	0 10.349	0 20.206	0 30.062	0 39.919	0 49.775	0 59.632	1 09.488	3	.008
4	0 00.657	0 10.514	0 20.370	0 30.227	0 40.083	0 49.939	0 59.796	1 09.652	4	.011
5	0 00.821	0 10.678	0 20.534	0 30.391	0 40.247	0 50.104	0 59.960	1 09.817	5	0.014
6	0 00.986	0 10.842	0 20.699	0 30.555	0 40.412	0 50.268	1 00.124	1 09.981	6	.016
7	0 01.150	0 11.006	0 20.863	0 30.719	0 40.576	0 50.432	1 00.289	1 10.145	7	.019
8	0 01.314	0 11.171	0 21.027	0 30.884	0 40.740	0 50.597	1 00.453	1 10.310	8	.022
9	0 01.478	0 11.335	0 21.191	0 31.048	0 40.904	0 50.761	1 00.617	1 10.474	9	.025
10	0 01.643	0 11.499	0 21.356	0 31.212	0 41.069	0 50.925	1 00.782	1 10.638	10	0.027
11	0 01.807	0 11.663	0 21.520	0 31.376	0 41.233	0 51.089	1 00.946	1 10.802	11	.030
12	0 01.971	0 11.828	0 21.684	0 31.541	0 41.397	0 51.254	1 01.110	1 10.967	12	.033
13	0 02.136	0 11.992	0 21.849	0 31.705	0 41.561	0 51.418	1 01.274	1 11.131	13	.036
14	0 02.300	0 12.156	0 22.013	0 31.869	0 41.726	0 51.582	1 01.439	1 11.295	14	.038
15	0 02.464	0 12.321	0 22.177	0 32.034	0 41.890	0 51.746	1 01.603	1 11.459	15	0.041
16	0 02.628	0 12.485	0 22.341	0 32.198	0 42.054	0 51.911	1 01.767	1 11.624	16	.044
17	0 02.793	0 12.649	0 22.506	0 32.362	0 42.219	0 52.075	1 01.932	1 11.788	17	.047
18	0 02.957	0 12.813	0 22.670	0 32.526	0 42.383	0 52.239	1 02.096	1 11.952	18	.049
19	0 03.121	0 12.978	0 22.834	0 32.691	0 42.547	0 52.404	1 02.260	1 12.117	19	.052
20	0 03.285	0 13.142	0 22.998	0 32.855	0 42.711	0 52.568	1 02.424	1 12.281	20	0.055
21	0 03.450	0 13.306	0 23.163	0 33.019	0 42.876	0 52.732	1 02.589	1 12.445	21	.057
22	0 03.614	0 13.471	0 23.327	0 33.183	0 43.040	0 52.896	1 02.753	1 12.609	22	.060
23	0 03.778	0 13.635	0 23.491	0 33.348	0 43.204	0 53.061	1 02.917	1 12.774	23	.063
24	0 03.943	0 13.799	0 23.656	0 33.512	0 43.368	0 53.225	1 03.081	1 12.938	24	.066
25	0 04.107	0 13.963	0 23.820	0 33.676	0 43.533	0 53.389	1 03.246	1 13.102	25	0.068
26	0 04.271	0 14.128	0 23.984	0 33.841	0 43.697	0 53.554	1 03.410	1 13.266	26	.071
27	0 04.435	0 14.292	0 24.148	0 34.005	0 43.861	0 53.718	1 03.574	1 13.431	27	.074
28	0 04.600	0 14.456	0 24.313	0 34.169	0 44.026	0 53.882	1 03.739	1 13.595	28	.077
29	0 04.764	0 14.620	0 24.477	0 34.333	0 44.190	0 54.046	1 03.903	1 13.759	29	.079
30	0 04.928	0 14.785	0 24.641	0 34.498	0 44.354	0 54.211	1 04.067	1 13.924	30	0.082
31	0 05.093	0 14.949	0 24.805	0 34.662	0 44.518	0 54.375	1 04.231	1 14.088	31	.085
32	0 05.257	0 15.113	0 24.970	0 34.826	0 44.683	0 54.539	1 04.396	1 14.252	32	.088
33	0 05.421	0 15.278	0 25.134	0 34.990	0 44.847	0 54.703	1 04.560	1 14.416	33	.090
34	0 05.585	0 15.442	0 25.298	0 35.155	0 45.011	0 54.868	1 04.724	1 14.581	34	.093
35	0 05.750	0 15.606	0 25.463	0 35.319	0 45.176	0 55.032	1 04.888	1 14.745	35	0.096
36	0 05.914	0 15.770	0 25.627	0 35.483	0 45.340	0 55.196	1 05.053	1 14.909	36	.099
37	0 06.078	0 15.935	0 25.791	0 35.648	0 45.504	0 55.361	1 05.217	1 15.073	37	.101
38	0 06.242	0 16.099	0 25.955	0 35.812	0 45.668	0 55.525	1 05.381	1 15.238	38	.104
39	0 06.407	0 16.263	0 26.120	0 35.976	0 45.833	0 55.689	1 05.546	1 15.402	39	.107
40	0 06.571	0 16.427	0 26.284	0 36.140	0 45.997	0 55.853	1 05.710	1 15.566	40	0.110
41	0 06.735	0 16.592	0 26.448	0 36.305	0 46.161	0 56.018	1 05.874	1 15.731	41	.112
42	0 06.900	0 16.756	0 26.612	0 36.469	0 46.325	0 56.182	1 06.038	1 15.895	42	.115
43	0 07.064	0 16.920	0 26.777	0 36.633	0 46.490	0 56.346	1 06.203	1 16.059	43	.118
44	0 07.228	0 17.085	0 26.941	0 36.798	0 46.654	0 56.510	1 06.367	1 16.223	44	.120
45	0 07.392	0 17.249	0 27.105	0 36.962	0 46.818	0 56.675	1 06.531	1 16.388	45	0.123
46	0 07.557	0 17.413	0 27.270	0 37.126	0 46.983	0 56.839	1 06.695	1 16.552	46	.126
47	0 07.721	0 17.577	0 27.434	0 37.290	0 47.147	0 57.003	1 06.860	1 16.716	47	.129
48	0 07.885	0 17.742	0 27.598	0 37.455	0 47.311	0 57.168	1 07.024	1 16.880	48	.131
49	0 08.049	0 17.906	0 27.762	0 37.619	0 47.475	0 57.332	1 07.188	1 17.045	49	.134
50	0 08.214	0 18.070	0 27.927	0 37.783	0 47.640	0 57.496	1 07.353	1 17.209	50	0.137
51	0 08.378	0 18.234	0 28.091	0 37.947	0 47.804	0 57.660	1 07.517	1 17.373	51	.140
52	0 08.542	0 18.399	0 28.255	0 38.112	0 47.968	0 57.825	1 07.681	1 17.538	52	.142
53	0 08.707	0 18.563	0 28.419	0 38.276	0 48.132	0 57.989	1 07.845	1 17.702	53	.145
54	0 08.871	0 18.727	0 28.584	0 38.440	0 48.297	0 58.153	1 08.010	1 17.866	54	.148
55	0 09.035	0 18.892	0 28.748	0 38.605	0 48.461	0 58.317	1 08.174	1 18.030	55	0.151
56	0 09.199	0 19.056	0 28.912	0 38.769	0 48.625	0 58.482	1 08.338	1 18.195	56	.153
57	0 09.364	0 19.220	0 29.077	0 38.933	0 48.790	0 58.646	1 08.502	1 18.359	57	.156
58	0 09.528	0 19.384	0 29.241	0 39.097	0 48.954	0 58.810	1 08.667	1 18.523	58	.159
59	0 09.692	0 19.549	0 29.405	0 39.262	0 49.118	0 58.975	1 08.831	1 18.688	59	0.162

Add tabular amount to mean solar time interval to obtain equivalent mean sidereal time interval.

CONVERSION OF MEAN SOLAR INTO MEAN SIDEREAL TIME

	8 ^h		9 ^h		10 ^h		11 ^h		12 ^h		13 ^h		14 ^h		15 ^h		SECONDS	
	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	s	s
0	1	18.852	1	28.708	1	38.565	1	48.421	1	58.278	2	08.134	2	17.991	2	27.847	0	0.000
1	1	19.016	1	28.873	1	38.729	1	48.585	1	58.442	2	08.298	2	18.155	2	28.011	1	.003
2	1	19.180	1	29.037	1	38.893	1	48.750	1	58.606	2	08.463	2	18.319	2	28.176	2	.005
3	1	19.345	1	29.201	1	39.058	1	48.914	1	58.771	2	08.627	2	18.483	2	28.340	3	.008
4	1	19.509	1	29.365	1	39.222	1	49.078	1	58.935	2	08.791	2	18.648	2	28.504	4	.011
5	1	19.673	1	29.530	1	39.386	1	49.243	1	59.099	2	08.956	2	18.812	2	28.668	5	0.014
6	1	19.837	1	29.694	1	39.550	1	49.407	1	59.263	2	09.120	2	18.976	2	28.833	6	.016
7	1	20.002	1	29.858	1	39.715	1	49.571	1	59.428	2	09.284	2	19.141	2	28.997	7	.019
8	1	20.166	1	30.022	1	39.879	1	49.735	1	59.592	2	09.448	2	19.305	2	29.161	8	.022
9	1	20.330	1	30.187	1	40.043	1	49.900	1	59.756	2	09.613	2	19.469	2	29.326	9	.025
10	1	20.495	1	30.351	1	40.207	1	50.064	1	59.920	2	09.777	2	19.633	2	29.490	10	0.027
11	1	20.659	1	30.515	1	40.372	1	50.228	2	00.085	2	09.941	2	19.798	2	29.654	11	.030
12	1	20.823	1	30.680	1	40.536	1	50.393	2	00.249	2	10.105	2	19.962	2	29.818	12	.033
13	1	20.987	1	30.844	1	40.700	1	50.557	2	00.413	2	10.270	2	20.126	2	29.983	13	.036
14	1	21.152	1	31.008	1	40.865	1	50.721	2	00.578	2	10.434	2	20.290	2	30.147	14	.038
15	1	21.316	1	31.172	1	41.029	1	50.885	2	00.742	2	10.598	2	20.455	2	30.311	15	0.041
16	1	21.480	1	31.337	1	41.193	1	51.050	2	00.906	2	10.763	2	20.619	2	30.475	16	.044
17	1	21.644	1	31.501	1	41.357	1	51.214	2	01.070	2	10.927	2	20.783	2	30.640	17	.047
18	1	21.809	1	31.665	1	41.522	1	51.378	2	01.235	2	11.091	2	20.948	2	30.804	18	.049
19	1	21.973	1	31.829	1	41.686	1	51.542	2	01.399	2	11.255	2	21.112	2	30.968	19	.052
20	1	22.137	1	31.994	1	41.850	1	51.707	2	01.563	2	11.420	2	21.276	2	31.133	20	0.055
21	1	22.302	1	32.158	1	42.015	1	51.871	2	01.727	2	11.584	2	21.440	2	31.297	21	.057
22	1	22.466	1	32.322	1	42.179	1	52.035	2	01.892	2	11.748	2	21.605	2	31.461	22	.060
23	1	22.630	1	32.487	1	42.343	1	52.200	2	02.056	2	11.912	2	21.769	2	31.625	23	.063
24	1	22.794	1	32.651	1	42.507	1	52.364	2	02.220	2	12.077	2	21.933	2	31.790	24	.066
25	1	22.959	1	32.815	1	42.672	1	52.528	2	02.385	2	12.241	2	22.097	2	31.954	25	0.068
26	1	23.123	1	32.979	1	42.836	1	52.692	2	02.549	2	12.405	2	22.262	2	32.118	26	.071
27	1	23.287	1	33.144	1	43.000	1	52.857	2	02.713	2	12.570	2	22.426	2	32.283	27	.074
28	1	23.451	1	33.308	1	43.164	1	53.021	2	02.877	2	12.734	2	22.590	2	32.447	28	.077
29	1	23.616	1	33.472	1	43.329	1	53.185	2	03.042	2	12.898	2	22.755	2	32.611	29	.079
30	1	23.780	1	33.636	1	43.493	1	53.349	2	03.206	2	13.062	2	22.919	2	32.775	30	0.082
31	1	23.944	1	33.801	1	43.657	1	53.514	2	03.370	2	13.227	2	23.083	2	32.940	31	.085
32	1	24.109	1	33.965	1	43.822	1	53.678	2	03.534	2	13.391	2	23.247	2	33.104	32	.088
33	1	24.273	1	34.129	1	43.986	1	53.842	2	03.699	2	13.555	2	23.412	2	33.268	33	.090
34	1	24.437	1	34.294	1	44.150	1	54.007	2	03.863	2	13.719	2	23.576	2	33.432	34	.093
35	1	24.601	1	34.458	1	44.314	1	54.171	2	04.027	2	13.884	2	23.740	2	33.597	35	0.096
36	1	24.766	1	34.622	1	44.479	1	54.335	2	04.192	2	14.048	2	23.905	2	33.761	36	.099
37	1	24.930	1	34.786	1	44.643	1	54.499	2	04.356	2	14.212	2	24.069	2	33.925	37	.101
38	1	25.094	1	34.951	1	44.807	1	54.664	2	04.520	2	14.377	2	24.233	2	34.090	38	.104
39	1	25.258	1	35.115	1	44.971	1	54.828	2	04.684	2	14.541	2	24.397	2	34.254	39	.107
40	1	25.423	1	35.279	1	45.136	1	54.992	2	04.849	2	14.705	2	24.562	2	34.418	40	0.110
41	1	25.587	1	35.444	1	45.300	1	55.156	2	05.013	2	14.869	2	24.726	2	34.582	41	.112
42	1	25.751	1	35.608	1	45.464	1	55.321	2	05.177	2	15.034	2	24.890	2	34.747	42	.115
43	1	25.916	1	35.772	1	45.629	1	55.485	2	05.341	2	15.198	2	25.054	2	34.911	43	.118
44	1	26.080	1	35.936	1	45.793	1	55.649	2	05.506	2	15.362	2	25.219	2	35.075	44	.120
45	1	26.244	1	36.101	1	45.957	1	55.814	2	05.670	2	15.527	2	25.383	2	35.239	45	0.123
46	1	26.408	1	36.265	1	46.121	1	55.978	2	05.834	2	15.691	2	25.547	2	35.404	46	.126
47	1	26.573	1	36.429	1	46.286	1	56.142	2	05.999	2	15.855	2	25.712	2	35.568	47	.129
48	1	26.737	1	36.593	1	46.450	1	56.306	2	06.163	2	16.019	2	25.876	2	35.732	48	.131
49	1	26.901	1	36.758	1	46.614	1	56.471	2	06.327	2	16.184	2	26.040	2	35.897	49	.134
50	1	27.066	1	36.922	1	46.778	1	56.635	2	06.491	2	16.348	2	26.204	2	36.061	50	0.137
51	1	27.230	1	37.086	1	46.943	1	56.799	2	06.656	2	16.512	2	26.369	2	36.225	51	.140
52	1	27.394	1	37.251	1	47.107	1	56.963	2	06.820	2	16.676	2	26.533	2	36.389	52	.142
53	1	27.558	1	37.415	1	47.271	1	57.128	2	06.984	2	16.841	2	26.697	2	36.554	53	.145
54	1	27.723	1	37.579	1	47.436	1	57.292	2	07.149	2	17.005	2	26.861	2	36.718	54	.148
55	1	27.887	1	37.743	1	47.600	1	57.456	2	07.313	2	17.169	2	27.026	2	36.882	55	0.151
56	1	28.051	1	37.908	1	47.764	1	57.621	2	07.477	2	17.334	2	27.190	2	37.046	56	.153
57	1	28.215	1	38.072	1	47.928	1	57.785	2	07.641	2	17.498	2	27.354	2	37.211	57	.156
58	1	28.380	1	38.236	1	48.093	1	57.949	2	07.806	2	17.662	2	27.519	2	37.375	58	.159
59	1	28.544	1	38.400	1	48.257	1	58.113	2	07.970	2	17.826	2	27.683	2	37.539	59	0.162

Add tabular amount to mean solar time interval to obtain equivalent mean sidereal time interval.

CONVERSION OF MEAN SOLAR INTO MEAN SIDEREAL TIME

	16 ^h	17 ^h	18 ^h	19 ^h	20 ^h	21 ^h	22 ^h	23 ^h	SECONDS	
m	m ^s	m ^s	m ^s	m ^s	m ^s	m ^s	m ^s	m ^s	s	s
0	2 37.704	2 47.560	2 57.417	3 07.273	3 17.129	3 26.986	3 36.842	3 46.699	0	0.000
1	2 37.868	2 47.724	2 57.581	3 07.437	3 17.294	3 27.150	3 37.007	3 46.863	1	.003
2	2 38.032	2 47.889	2 57.745	3 07.602	3 17.458	3 27.314	3 37.171	3 47.027	2	.005
3	2 38.196	2 48.053	2 57.909	3 07.766	3 17.622	3 27.479	3 37.335	3 47.192	3	.008
4	2 38.361	2 48.217	2 58.074	3 07.930	3 17.787	3 27.643	3 37.500	3 47.356	4	.011
5	2 38.525	2 48.381	2 58.238	3 08.094	3 17.951	3 27.807	3 37.664	3 47.520	5	0.014
6	2 38.689	2 48.546	2 58.402	3 08.259	3 18.115	3 27.972	3 37.828	3 47.685	6	.016
7	2 38.853	2 48.710	2 58.566	3 08.423	3 18.279	3 28.136	3 37.992	3 47.849	7	.019
8	2 39.018	2 48.874	2 58.731	3 08.587	3 18.444	3 28.300	3 38.157	3 48.013	8	.022
9	2 39.182	2 49.039	2 58.895	3 08.751	3 18.608	3 28.464	3 38.321	3 48.177	9	.025
10	2 39.346	2 49.203	2 59.059	3 08.916	3 18.772	3 28.629	3 38.485	3 48.342	10	0.027
11	2 39.511	2 49.367	2 59.224	3 09.080	3 18.936	3 28.793	3 38.649	3 48.506	11	.030
12	2 39.675	2 49.531	2 59.388	3 09.244	3 19.101	3 28.957	3 38.814	3 48.670	12	.033
13	2 39.839	2 49.696	2 59.552	3 09.409	3 19.265	3 29.122	3 38.978	3 48.834	13	.036
14	2 40.003	2 49.860	2 59.716	3 09.573	3 19.429	3 29.286	3 39.142	3 48.999	14	.038
15	2 40.168	2 50.024	2 59.881	3 09.737	3 19.594	3 29.450	3 39.307	3 49.163	15	0.041
16	2 40.332	2 50.188	3 00.045	3 09.901	3 19.758	3 29.614	3 39.471	3 49.327	16	.044
17	2 40.496	2 50.353	3 00.209	3 10.066	3 19.922	3 29.779	3 39.635	3 49.492	17	.047
18	2 40.661	2 50.517	3 00.373	3 10.230	3 20.086	3 29.943	3 39.799	3 49.656	18	.049
19	2 40.825	2 50.681	3 00.538	3 10.394	3 20.251	3 30.107	3 39.964	3 49.820	19	.052
20	2 40.989	2 50.846	3 00.702	3 10.558	3 20.415	3 30.271	3 40.128	3 49.984	20	0.055
21	2 41.153	2 51.010	3 00.866	3 10.723	3 20.579	3 30.436	3 40.292	3 50.149	21	.057
22	2 41.318	2 51.174	3 01.031	3 10.887	3 20.744	3 30.600	3 40.456	3 50.313	22	.060
23	2 41.482	2 51.338	3 01.195	3 11.051	3 20.908	3 30.764	3 40.621	3 50.477	23	.063
24	2 41.646	2 51.503	3 01.359	3 11.216	3 21.072	3 30.929	3 40.785	3 50.641	24	.066
25	2 41.810	2 51.667	3 01.523	3 11.380	3 21.236	3 31.093	3 40.949	3 50.806	25	0.068
26	2 41.975	2 51.831	3 01.688	3 11.544	3 21.401	3 31.257	3 41.114	3 50.970	26	.071
27	2 42.139	2 51.995	3 01.852	3 11.708	3 21.565	3 31.421	3 41.278	3 51.134	27	.074
28	2 42.303	2 52.160	3 02.016	3 11.873	3 21.729	3 31.586	3 41.442	3 51.299	28	.077
29	2 42.468	2 52.324	3 02.180	3 12.037	3 21.893	3 31.750	3 41.606	3 51.463	29	.079
30	2 42.632	2 52.488	3 02.345	3 12.201	3 22.058	3 31.914	3 41.771	3 51.627	30	0.082
31	2 42.796	2 52.653	3 02.509	3 12.366	3 22.222	3 32.078	3 41.935	3 51.791	31	.085
32	2 42.960	2 52.817	3 02.673	3 12.530	3 22.386	3 32.243	3 42.099	3 51.956	32	.088
33	2 43.125	2 52.981	3 02.838	3 12.694	3 22.551	3 32.407	3 42.263	3 52.120	33	.090
34	2 43.289	2 53.145	3 03.002	3 12.858	3 22.715	3 32.571	3 42.428	3 52.284	34	.093
35	2 43.453	2 53.310	3 03.166	3 13.023	3 22.879	3 32.736	3 42.592	3 52.448	35	0.096
36	2 43.617	2 53.474	3 03.330	3 13.187	3 23.043	3 32.900	3 42.756	3 52.613	36	.099
37	2 43.782	2 53.638	3 03.495	3 13.351	3 23.208	3 33.064	3 42.921	3 52.777	37	.101
38	2 43.946	2 53.802	3 03.659	3 13.515	3 23.372	3 33.228	3 43.085	3 52.941	38	.104
39	2 44.110	2 53.967	3 03.823	3 13.680	3 23.536	3 33.393	3 43.249	3 53.106	39	.107
40	2 44.275	2 54.131	3 03.988	3 13.844	3 23.700	3 33.557	3 43.413	3 53.270	40	0.110
41	2 44.439	2 54.295	3 04.152	3 14.008	3 23.865	3 33.721	3 43.578	3 53.434	41	.112
42	2 44.603	2 54.460	3 04.316	3 14.173	3 24.029	3 33.885	3 43.742	3 53.598	42	.115
43	2 44.767	2 54.624	3 04.480	3 14.337	3 24.193	3 34.050	3 43.906	3 53.763	43	.118
44	2 44.932	2 54.788	3 04.645	3 14.501	3 24.358	3 34.214	3 44.070	3 53.927	44	.120
45	2 45.096	2 54.952	3 04.809	3 14.665	3 24.522	3 34.378	3 44.235	3 54.091	45	0.123
46	2 45.260	2 55.117	3 04.973	3 14.830	3 24.686	3 34.543	3 44.399	3 54.256	46	.126
47	2 45.424	2 55.281	3 05.137	3 14.994	3 24.850	3 34.707	3 44.563	3 54.420	47	.129
48	2 45.589	2 55.445	3 05.302	3 15.158	3 25.015	3 34.871	3 44.728	3 54.584	48	.131
49	2 45.753	2 55.610	3 05.466	3 15.322	3 25.179	3 35.035	3 44.892	3 54.748	49	.134
50	2 45.917	2 55.774	3 05.630	3 15.487	3 25.343	3 35.200	3 45.056	3 54.913	50	0.137
51	2 46.082	2 55.938	3 05.795	3 15.651	3 25.507	3 35.364	3 45.220	3 55.077	51	.140
52	2 46.246	2 56.102	3 05.959	3 15.815	3 25.672	3 35.528	3 45.385	3 55.241	52	.142
53	2 46.410	2 56.267	3 06.123	3 15.980	3 25.836	3 35.692	3 45.549	3 55.405	53	.145
54	2 46.574	2 56.431	3 06.287	3 16.144	3 26.000	3 35.857	3 45.713	3 55.570	54	.148
55	2 46.739	2 56.595	3 06.452	3 16.308	3 26.165	3 36.021	3 45.878	3 55.734	55	0.151
56	2 46.903	2 56.759	3 06.616	3 16.472	3 26.329	3 36.185	3 46.042	3 55.898	56	.153
57	2 47.067	2 56.924	3 06.780	3 16.637	3 26.493	3 36.350	3 46.206	3 56.063	57	.156
58	2 47.232	2 57.088	3 06.944	3 16.801	3 26.657	3 36.514	3 46.370	3 56.227	58	.159
59	2 47.396	2 57.252	3 07.109	3 16.965	3 26.822	3 36.678	3 46.535	3 56.391	59	0.162

Add tabular amount to mean solar time interval to obtain equivalent mean sidereal time interval.

CONVERSION OF HOURS, MINUTES, AND SECONDS TO DECIMALS OF A DAY

	0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	SECONDS	
	d	d	d	d	d	d	s	d
m								
0	0.000 000	0.041 667	0.083 333	0.125 000	0.166 667	0.208 333	0	0.000 000
1	.000 694	.042 361	.084 028	.125 694	.167 361	.209 028	1	.000 012
2	.001 389	.043 056	.084 722	.126 389	.168 056	.209 722	2	.000 023
3	.002 083	.043 750	.085 417	.127 083	.168 750	.210 417	3	.000 035
4	.002 778	.044 444	.086 111	.127 778	.169 444	.211 111	4	.000 046
5	0.003 472	0.045 139	0.086 806	0.128 472	0.170 139	0.211 806	5	0.000 058
6	.004 167	.045 833	.087 500	.129 167	.170 833	.212 500	6	.000 069
7	.004 861	.046 528	.088 194	.129 861	.171 528	.213 194	7	.000 081
8	.005 556	.047 222	.088 889	.130 556	.172 222	.213 889	8	.000 093
9	.006 250	.047 917	.089 583	.131 250	.172 917	.214 583	9	.000 104
10	0.006 944	0.048 611	0.090 278	0.131 944	0.173 611	0.215 278	10	0.000 116
11	.007 639	.049 306	.090 972	.132 639	.174 306	.215 972	11	.000 127
12	.008 333	.050 000	.091 667	.133 333	.175 000	.216 667	12	.000 139
13	.009 028	.050 694	.092 361	.134 028	.175 694	.217 361	13	.000 150
14	.009 722	.051 389	.093 056	.134 722	.176 389	.218 056	14	.000 162
15	0.010 417	0.052 083	0.093 750	0.135 417	0.177 083	0.218 750	15	0.000 174
16	.011 111	.052 778	.094 444	.136 111	.177 778	.219 444	16	.000 185
17	.011 806	.053 472	.095 139	.136 806	.178 472	.220 139	17	.000 197
18	.012 500	.054 167	.095 833	.137 500	.179 167	.220 833	18	.000 208
19	.013 194	.054 861	.096 528	.138 194	.179 861	.221 528	19	.000 220
20	0.013 889	0.055 556	0.097 222	0.138 889	0.180 556	0.222 222	20	0.000 231
21	.014 583	.056 250	.097 917	.139 583	.181 250	.222 917	21	.000 243
22	.015 278	.056 944	.098 611	.140 278	.181 944	.223 611	22	.000 255
23	.015 972	.057 639	.099 306	.140 972	.182 639	.224 306	23	.000 266
24	.016 667	.058 333	.100 000	.141 667	.183 333	.225 000	24	.000 278
25	0.017 361	0.059 028	0.100 694	0.142 361	0.184 028	0.225 694	25	0.000 289
26	.018 056	.059 722	.101 389	.143 056	.184 722	.226 389	26	.000 301
27	.018 750	.060 417	.102 083	.143 750	.185 417	.227 083	27	.000 312
28	.019 444	.061 111	.102 778	.144 444	.186 111	.227 778	28	.000 324
29	.020 139	.061 806	.103 472	.145 139	.186 806	.228 472	29	.000 336
30	0.020 833	0.062 500	0.104 167	0.145 833	0.187 500	0.229 167	30	0.000 347
31	.021 528	.063 194	.104 861	.146 528	.188 194	.229 861	31	.000 359
32	.022 222	.063 889	.105 556	.147 222	.188 889	.230 556	32	.000 370
33	.022 917	.064 583	.106 250	.147 917	.189 583	.231 250	33	.000 382
34	.023 611	.065 278	.106 944	.148 611	.190 278	.231 944	34	.000 394
35	0.024 306	0.065 972	0.107 639	0.149 306	0.190 972	0.232 639	35	0.000 405
36	.025 000	.066 667	.108 333	.150 000	.191 667	.233 333	36	.000 417
37	.025 694	.067 361	.109 028	.150 694	.192 361	.234 028	37	.000 428
38	.026 389	.068 056	.109 722	.151 389	.193 056	.234 722	38	.000 440
39	.027 083	.068 750	.110 417	.152 083	.193 750	.235 417	39	.000 451
40	0.027 778	0.069 444	0.111 111	0.152 778	0.194 444	0.236 111	40	0.000 463
41	.028 472	.070 139	.111 806	.153 472	.195 139	.236 806	41	.000 475
42	.029 167	.070 833	.112 500	.154 167	.195 833	.237 500	42	.000 486
43	.029 861	.071 528	.113 194	.154 861	.196 528	.238 194	43	.000 498
44	.030 556	.072 222	.113 889	.155 556	.197 222	.238 889	44	.000 509
45	0.031 250	0.072 917	0.114 583	0.156 250	0.197 917	0.239 583	45	0.000 521
46	.031 944	.073 611	.115 278	.156 944	.198 611	.240 278	46	.000 532
47	.032 639	.074 306	.115 972	.157 639	.199 306	.240 972	47	.000 544
48	.033 333	.075 000	.116 667	.158 333	.200 000	.241 667	48	.000 556
49	.034 028	.075 694	.117 361	.159 028	.200 694	.242 361	49	.000 567
50	0.034 722	0.076 389	0.118 056	0.159 722	0.201 389	0.243 056	50	0.000 579
51	.035 417	.077 083	.118 750	.160 417	.202 083	.243 750	51	.000 590
52	.036 111	.077 778	.119 444	.161 111	.202 778	.244 444	52	.000 602
53	.036 806	.078 472	.120 139	.161 806	.203 472	.245 139	53	.000 613
54	.037 500	.079 167	.120 833	.162 500	.204 167	.245 833	54	.000 625
55	0.038 194	0.079 861	0.121 528	0.163 194	0.204 861	0.246 528	55	0.000 637
56	.038 889	.080 556	.122 222	.163 889	.205 556	.247 222	56	.000 648
57	.039 583	.081 250	.122 917	.164 583	.206 250	.247 917	57	.000 660
58	.040 278	.081 944	.123 611	.165 278	.206 944	.248 611	58	.000 671
59	0.040 972	0.082 639	0.124 306	0.165 972	0.207 639	0.249 306	59	0.000 683

TABLE X

CONVERSION OF HOURS, MINUTES, AND SECONDS TO DECIMALS OF A DAY

m	6 ^h	7 ^h	8 ^h	9 ^h	10 ^h	11 ^h	SECONDS	
	d	d	d	d	d	d	s	d
0	0.250 000	0.291 667	0.333 333	0.375 000	0.416 667	0.458 333	0	0.000 000
1	.250 694	.292 361	.334 028	.375 694	.417 361	.459 028	1	.000 012
2	.251 389	.293 056	.334 722	.376 389	.418 056	.459 722	2	.000 023
3	.252 083	.293 750	.335 417	.377 083	.418 750	.460 417	3	.000 035
4	.252 778	.294 444	.336 111	.377 778	.419 444	.461 111	4	.000 046
5	0.253 472	0.295 139	0.336 806	0.378 472	0.420 139	0.461 806	5	0.000 058
6	.254 167	.295 833	.337 500	.379 167	.420 833	.462 500	6	.000 069
7	.254 861	.296 528	.338 194	.379 861	.421 528	.463 194	7	.000 081
8	.255 556	.297 222	.338 889	.380 556	.422 222	.463 889	8	.000 093
9	.256 250	.297 917	.339 583	.381 250	.422 917	.464 583	9	.000 104
10	0.256 944	0.298 611	0.340 278	0.381 944	0.423 611	0.465 278	10	0.000 116
11	.257 639	.299 306	.340 972	.382 639	.424 306	.465 972	11	.000 127
12	.258 333	.300 000	.341 667	.383 333	.425 000	.466 667	12	.000 139
13	.259 028	.300 694	.342 361	.384 028	.425 694	.467 361	13	.000 150
14	.259 722	.301 389	.343 056	.384 722	.426 389	.468 056	14	.000 162
15	0.260 417	0.302 083	0.343 750	0.385 417	0.427 083	0.468 750	15	0.000 174
16	.261 111	.302 778	.344 444	.386 111	.427 778	.469 444	16	.000 185
17	.261 806	.303 472	.345 139	.386 806	.428 472	.470 139	17	.000 197
18	.262 500	.304 167	.345 833	.387 500	.429 167	.470 833	18	.000 208
19	.263 194	.304 861	.346 528	.388 194	.429 861	.471 528	19	.000 220
20	0.263 889	0.305 556	0.347 222	0.388 889	0.430 556	0.472 222	20	0.000 231
21	.264 583	.306 250	.347 917	.389 583	.431 250	.472 917	21	.000 243
22	.265 278	.306 944	.348 611	.390 278	.431 944	.473 611	22	.000 255
23	.265 972	.307 639	.349 306	.390 972	.432 639	.474 306	23	.000 266
24	.266 667	.308 333	.350 000	.391 667	.433 333	.475 000	24	.000 278
25	0.267 361	0.309 028	0.350 694	0.392 361	0.434 028	0.475 694	25	0.000 289
26	.268 056	.309 722	.351 389	.393 056	.434 722	.476 389	26	.000 301
27	.268 750	.310 417	.352 083	.393 750	.435 417	.477 083	27	.000 312
28	.269 444	.311 111	.352 778	.394 444	.436 111	.477 778	28	.000 324
29	.270 139	.311 806	.353 472	.395 139	.436 806	.478 472	29	.000 336
30	0.270 833	0.312 500	0.354 167	0.395 833	0.437 500	0.479 167	30	0.000 347
31	.271 528	.313 194	.354 861	.396 528	.438 194	.479 861	31	.000 359
32	.272 222	.313 889	.355 556	.397 222	.438 889	.480 556	32	.000 370
33	.272 917	.314 583	.356 250	.397 917	.439 583	.481 250	33	.000 382
34	.273 611	.315 278	.356 944	.398 611	.440 278	.481 944	34	.000 394
35	0.274 306	0.315 972	0.357 639	0.399 306	0.440 972	0.482 639	35	0.000 405
36	.275 000	.316 667	.358 333	.400 000	.441 667	.483 333	36	.000 417
37	.275 694	.317 361	.359 028	.400 694	.442 361	.484 028	37	.000 428
38	.276 389	.318 056	.359 722	.401 389	.443 056	.484 722	38	.000 440
39	.277 083	.318 750	.360 417	.402 083	.443 750	.485 417	39	.000 451
40	0.277 778	0.319 444	0.361 111	0.402 778	0.444 444	0.486 111	40	0.000 463
41	.278 472	.320 139	.361 806	.403 472	.445 139	.486 806	41	.000 475
42	.279 167	.320 833	.362 500	.404 167	.445 833	.487 500	42	.000 486
43	.279 861	.321 528	.363 194	.404 861	.446 528	.488 194	43	.000 498
44	.280 556	.322 222	.363 889	.405 556	.447 222	.488 889	44	.000 509
45	0.281 250	0.322 917	0.364 583	0.406 250	0.447 917	0.489 583	45	0.000 521
46	.281 944	.323 611	.365 278	.406 944	.448 611	.490 278	46	.000 532
47	.282 639	.324 306	.365 972	.407 639	.449 306	.490 972	47	.000 544
48	.283 333	.325 000	.366 667	.408 333	.450 000	.491 667	48	.000 556
49	.284 028	.325 694	.367 361	.409 028	.450 694	.492 361	49	.000 567
50	0.284 722	0.326 389	0.368 056	0.409 722	0.451 389	0.493 056	50	0.000 579
51	.285 417	.327 083	.368 750	.410 417	.452 083	.493 750	51	.000 590
52	.286 111	.327 778	.369 444	.411 111	.452 778	.494 444	52	.000 602
53	.286 806	.328 472	.370 139	.411 806	.453 472	.495 139	53	.000 613
54	.287 500	.329 167	.370 833	.412 500	.454 167	.495 833	54	.000 625
55	0.288 194	0.329 861	0.371 528	0.413 194	0.454 861	0.496 528	55	0.000 637
56	.288 889	.330 556	.372 222	.413 889	.455 556	.497 222	56	.000 648
57	.289 583	.331 250	.372 917	.414 583	.456 250	.497 917	57	.000 660
58	.290 278	.331 944	.373 611	.415 278	.456 944	.498 611	58	.000 671
59	0.290 972	0.332 639	0.374 306	0.415 972	0.457 639	0.499 306	59	0.000 683

TABLE XI
CONVERSION OF TIME TO ARC

m	0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	SECONDS					
	° ' ''	° ' ''	° ' ''	° ' ''	° ' ''	° ' ''	s ' ''	s ' ''	s ' ''	s ' ''		
0	0 00	15 00	30 00	45 00	60 00	75 00	0 0 00	0.00	0.00	0.50	7.50	
1	0 15	15 15	30 15	45 15	60 15	75 15	1 0 15	.01	0.15	.51	7.65	
2	0 30	15 30	30 30	45 30	60 30	75 30	2 0 30	.02	0.30	.52	7.80	
3	0 45	15 45	30 45	45 45	60 45	75 45	3 0 45	.03	0.45	.53	7.95	
4	1 00	16 00	31 00	46 00	61 00	76 00	4 1 00	.04	0.60	.54	8.10	
5	1 15	16 15	31 15	46 15	61 15	76 15	5 1 15	0.05	0.75	0.55	8.25	
6	1 30	16 30	31 30	46 30	61 30	76 30	6 1 30	.06	0.90	.56	8.40	
7	1 45	16 45	31 45	46 45	61 45	76 45	7 1 45	.07	1.05	.57	8.55	
8	2 00	17 00	32 00	47 00	62 00	77 00	8 2 00	.08	1.20	.58	8.70	
9	2 15	17 15	32 15	47 15	62 15	77 15	9 2 15	.09	1.35	.59	8.85	
10	2 30	17 30	32 30	47 30	62 30	77 30	10 2 30	0.10	1.50	0.60	9.00	
11	2 45	17 45	32 45	47 45	62 45	77 45	11 2 45	.11	1.65	.61	9.15	
12	3 00	18 00	33 00	48 00	63 00	78 00	12 3 00	.12	1.80	.62	9.30	
13	3 15	18 15	33 15	48 15	63 15	78 15	13 3 15	.13	1.95	.63	9.45	
14	3 30	18 30	33 30	48 30	63 30	78 30	14 3 30	.14	2.10	.64	9.60	
15	3 45	18 45	33 45	48 45	63 45	78 45	15 3 45	0.15	2.25	0.65	9.75	
16	4 00	19 00	34 00	49 00	64 00	79 00	16 4 00	.16	2.40	.66	9.90	
17	4 15	19 15	34 15	49 15	64 15	79 15	17 4 15	.17	2.55	.67	10.05	
18	4 30	19 30	34 30	49 30	64 30	79 30	18 4 30	.18	2.70	.68	10.20	
19	4 45	19 45	34 45	49 45	64 45	79 45	19 4 45	.19	2.85	.69	10.35	
20	5 00	20 00	35 00	50 00	65 00	80 00	20 5 00	0.20	3.00	0.70	10.50	
21	5 15	20 15	35 15	50 15	65 15	80 15	21 5 15	.21	3.15	.71	10.65	
22	5 30	20 30	35 30	50 30	65 30	80 30	22 5 30	.22	3.30	.72	10.80	
23	5 45	20 45	35 45	50 45	65 45	80 45	23 5 45	.23	3.45	.73	10.95	
24	6 00	21 00	36 00	51 00	66 00	81 00	24 6 00	.24	3.60	.74	11.10	
25	6 15	21 15	36 15	51 15	66 15	81 15	25 6 15	0.25	3.75	0.75	11.25	
26	6 30	21 30	36 30	51 30	66 30	81 30	26 6 30	.26	3.90	.76	11.40	
27	6 45	21 45	36 45	51 45	66 45	81 45	27 6 45	.27	4.05	.77	11.55	
28	7 00	22 00	37 00	52 00	67 00	82 00	28 7 00	.28	4.20	.78	11.70	
29	7 15	22 15	37 15	52 15	67 15	82 15	29 7 15	.29	4.35	.79	11.85	
30	7 30	22 30	37 30	52 30	67 30	82 30	30 7 30	0.30	4.50	0.80	12.00	
31	7 45	22 45	37 45	52 45	67 45	82 45	31 7 45	.31	4.65	.81	12.15	
32	8 00	23 00	38 00	53 00	68 00	83 00	32 8 00	.32	4.80	.82	12.30	
33	8 15	23 15	38 15	53 15	68 15	83 15	33 8 15	.33	4.95	.83	12.45	
34	8 30	23 30	38 30	53 30	68 30	83 30	34 8 30	.34	5.10	.84	12.60	
35	8 45	23 45	38 45	53 45	68 45	83 45	35 8 45	0.35	5.25	0.85	12.75	
36	9 00	24 00	39 00	54 00	69 00	84 00	36 9 00	.36	5.40	.86	12.90	
37	9 15	24 15	39 15	54 15	69 15	84 15	37 9 15	.37	5.55	.87	13.05	
38	9 30	24 30	39 30	54 30	69 30	84 30	38 9 30	.38	5.70	.88	13.20	
39	9 45	24 45	39 45	54 45	69 45	84 45	39 9 45	.39	5.85	.89	13.35	
40	10 00	25 00	40 00	55 00	70 00	85 00	40 10 00	0.40	6.00	0.90	13.50	
41	10 15	25 15	40 15	55 15	70 15	85 15	41 10 15	.41	6.15	.91	13.65	
42	10 30	25 30	40 30	55 30	70 30	85 30	42 10 30	.42	6.30	.92	13.80	
43	10 45	25 45	40 45	55 45	70 45	85 45	43 10 45	.43	6.45	.93	13.95	
44	11 00	26 00	41 00	56 00	71 00	86 00	44 11 00	.44	6.60	.94	14.10	
45	11 15	26 15	41 15	56 15	71 15	86 15	45 11 15	0.45	6.75	0.95	14.25	
46	11 30	26 30	41 30	56 30	71 30	86 30	46 11 30	.46	6.90	.96	14.40	
47	11 45	26 45	41 45	56 45	71 45	86 45	47 11 45	.47	7.05	.97	14.55	
48	12 00	27 00	42 00	57 00	72 00	87 00	48 12 00	.48	7.20	.98	14.70	
49	12 15	27 15	42 15	57 15	72 15	87 15	49 12 15	.49	7.35	0.99	14.85	
50	12 30	27 30	42 30	57 30	72 30	87 30	50 12 30	0.50	7.50	1.00	15.00	
51	12 45	27 45	42 45	57 45	72 45	87 45	51 12 45					
52	13 00	28 00	43 00	58 00	73 00	88 00	52 13 00					
53	13 15	28 15	43 15	58 15	73 15	88 15	53 13 15					
54	13 30	28 30	43 30	58 30	73 30	88 30	54 13 30					
55	13 45	28 45	43 45	58 45	73 45	88 45	55 13 45					
56	14 00	29 00	44 00	59 00	74 00	89 00	56 14 00					
57	14 15	29 15	44 15	59 15	74 15	89 15	57 14 15					
58	14 30	29 30	44 30	59 30	74 30	89 30	58 14 30					
59	14 45	29 45	44 45	59 45	74 45	89 45	59 14 45					

CONVERSION OF ARC TO TIME

DEGREES						MINUTES		SECONDS					
°	h	m	°	h	m	°	h	m	s	°	h	m	s
0	0	00	60	4	00	120	8	00	0	0.000	0.00	0.000	0.50
1	0	04	61	4	04	121	8	04	1	0.067	.01	.001	.51
2	0	08	62	4	08	122	8	08	2	0.133	.02	.001	.52
3	0	12	63	4	12	123	8	12	3	0.200	.03	.002	.53
4	0	16	64	4	16	124	8	16	4	0.267	.04	.003	.54
5	0	20	65	4	20	125	8	20	5	0.333	0.05	0.003	0.55
6	0	24	66	4	24	126	8	24	6	0.400	.06	.004	.56
7	0	28	67	4	28	127	8	28	7	0.467	.07	.005	.57
8	0	32	68	4	32	128	8	32	8	0.533	.08	.005	.58
9	0	36	69	4	36	129	8	36	9	0.600	.09	.006	.59
10	0	40	70	4	40	130	8	40	10	0.667	0.10	0.007	0.60
11	0	44	71	4	44	131	8	44	11	0.733	.11	.007	.61
12	0	48	72	4	48	132	8	48	12	0.800	.12	.008	.62
13	0	52	73	4	52	133	8	52	13	0.867	.13	.009	.63
14	0	56	74	4	56	134	8	56	14	0.933	.14	.009	.64
15	1	00	75	5	00	135	9	00	15	1.000	0.15	0.010	0.65
16	1	04	76	5	04	136	9	04	16	1.067	.16	.011	.66
17	1	08	77	5	08	137	9	08	17	1.133	.17	.011	.67
18	1	12	78	5	12	138	9	12	18	1.200	.18	.012	.68
19	1	16	79	5	16	139	9	16	19	1.267	.19	.013	.69
20	1	20	80	5	20	140	9	20	20	1.333	0.20	0.013	0.70
21	1	24	81	5	24	141	9	24	21	1.400	.21	.014	.71
22	1	28	82	5	28	142	9	28	22	1.467	.22	.015	.72
23	1	32	83	5	32	143	9	32	23	1.533	.23	.015	.73
24	1	36	84	5	36	144	9	36	24	1.600	.24	.016	.74
25	1	40	85	5	40	145	9	40	25	1.667	0.25	0.017	0.75
26	1	44	86	5	44	146	9	44	26	1.733	.26	.017	.76
27	1	48	87	5	48	147	9	48	27	1.800	.27	.018	.77
28	1	52	88	5	52	148	9	52	28	1.867	.28	.019	.78
29	1	56	89	5	56	149	9	56	29	1.933	.29	.019	.79
30	2	00	90	6	00	150	10	00	30	2.000	0.30	0.020	0.80
31	2	04	91	6	04	151	10	04	31	2.067	.31	.021	.81
32	2	08	92	6	08	152	10	08	32	2.133	.32	.021	.82
33	2	12	93	6	12	153	10	12	33	2.200	.33	.022	.83
34	2	16	94	6	16	154	10	16	34	2.267	.34	.023	.84
35	2	20	95	6	20	155	10	20	35	2.333	0.35	0.023	0.85
36	2	24	96	6	24	156	10	24	36	2.400	.36	.024	.86
37	2	28	97	6	28	157	10	28	37	2.467	.37	.025	.87
38	2	32	98	6	32	158	10	32	38	2.533	.38	.025	.88
39	2	36	99	6	36	159	10	36	39	2.600	.39	.026	.89
40	2	40	100	6	40	160	10	40	40	2.667	0.40	0.027	0.90
41	2	44	101	6	44	161	10	44	41	2.733	.41	.027	.91
42	2	48	102	6	48	162	10	48	42	2.800	.42	.028	.92
43	2	52	103	6	52	163	10	52	43	2.867	.43	.029	.93
44	2	56	104	6	56	164	10	56	44	2.933	.44	.029	.94
45	3	00	105	7	00	165	11	00	45	3.000	0.45	0.030	0.95
46	3	04	106	7	04	166	11	04	46	3.067	.46	.031	.96
47	3	08	107	7	08	167	11	08	47	3.133	.47	.031	.97
48	3	12	108	7	12	168	11	12	48	3.200	.48	.032	.98
49	3	16	109	7	16	169	11	16	49	3.267	.49	.033	.99
50	3	20	110	7	20	170	11	20	50	3.333	0.50	0.033	1.00
51	3	24	111	7	24	171	11	24	51	3.400			
52	3	28	112	7	28	172	11	28	52	3.467			
53	3	32	113	7	32	173	11	32	53	3.533			
54	3	36	114	7	36	174	11	36	54	3.600			
55	3	40	115	7	40	175	11	40	55	3.667			
56	3	44	116	7	44	176	11	44	56	3.733			
57	3	48	117	7	48	177	11	48	57	3.800			
58	3	52	118	7	52	178	11	52	58	3.867			
59	3	56	119	7	56	179	11	56	59	3.933			

90° = 6^h180° = 12^h270° = 18^h

NOTATION

Arg. Function		Differences				$f(t_p)=f(t_0+ph)=f_p$
		1st	2nd	3rd	4th	$\delta_p=f_{p+\frac{1}{2}}-f_{p-\frac{1}{2}} \quad \delta_p^2=\delta(\delta_p)$
t_{-2}	f_{-2}					$\delta_{\frac{1}{2}}=f_1-f_0 \quad \delta_0^2+\delta_1^2=\delta_{1\frac{1}{2}}-\delta_{-\frac{1}{2}}$
t_{-1}	f_{-1}	$\delta_{-1\frac{1}{2}}$	δ_{-1}^2			$\delta_0^2=\delta_{\frac{1}{2}}-\delta_{-\frac{1}{2}}=f_1-2f_0+f_{-1}$
t_0	f_0	$\delta_{-\frac{1}{2}}$	δ_0^2	$\delta_{-\frac{1}{2}}^3$	δ_0^4	$\delta_{\frac{1}{2}}^3=\delta_1^2-\delta_0^2=f_2-3f_1+3f_0-f_{-1}$
t_1	f_1	$\delta_{\frac{1}{2}}$	δ_1^2	$\delta_{\frac{1}{2}}^3$		$\delta_0^4=\delta_{\frac{1}{2}}^3-\delta_{-\frac{1}{2}}^3=f_2-4f_1+6f_0-4f_{-1}+f_{-2}$
t_2	f_2	$\delta_{1\frac{1}{2}}$				

BESSEL'S INTERPOLATION FORMULA

$$f_p=f_0+p\delta_{\frac{1}{2}}+B_2(\delta_0^2+\delta_1^2)+B_3\delta_{\frac{1}{2}}^3+B_4(\delta_0^4+\delta_1^4)+\dots$$

The maximum truncation error of the interpolate f_p from neglecting each order of difference is less than 0.5 in the unit of the end figure of the tabular function if

$$\delta^2 < 4 \quad \delta^3 < 60 \quad \delta^4 < 20 \quad \delta^5 < 500$$

If δ^2 is replaced by $\delta_m^2=\delta^2-0.184 \delta^4$, the corresponding limit for δ^4 is raised to 1000; $\delta_{\frac{1}{2}}^3$ may be replaced by $\delta_{m1}^2-\delta_{m0}^2$.

PRECEPTS FOR USING THE TABLES

Table XIII. Round the interpolating factor p to 4 decimals; the required value of B_2 is the tabular value opposite the interval in which p lies or, if p exactly equals a tabular argument, the value above and to the right of p . The effects of third and fourth differences can be estimated from the values of B_3 and B_4 in the last column.

Table XIV. The table is entered with the tabular arguments nearest the true values of p and $\delta_0^2+\delta_1^2$, to obtain directly the value of the second-difference correction; this correction always has the opposite sign to $\delta_0^2+\delta_1^2$.

Table XV. The value of B_2 may be obtained by mental linear interpolation since the first difference of B_2 is never greater than 4. The corrections for third and fourth differences, which are usually necessary when Table XIII cannot be used, are taken from the Tables XVI and XVII; these tables are similar to Table XIV, but include a guarding decimal, and require mental interpolation for some ranges of the argument, to reduce the error of the interpolate.

Errors. In addition to the truncation error, an interpolate is subject to errors from the following sources:

		Maximum error
$f_0+p\delta_{\frac{1}{2}}$	Rounding errors in f_0, f_1	0.5
$B_2(\delta_0^2+\delta_1^2)+B_3\delta_{\frac{1}{2}}^3+\dots$	Rounding errors in tabular values	0.2
$B_2(\delta_0^2+\delta_1^2)$	Rounding error of B_2 from Table XIII	0.00051($\delta_0^2-\delta_1^2$)
$B_2(\delta_0^2+\delta_1^2)$	Table XIV, using nearest arguments	0.7
$B_2(\delta_0^2+\delta_1^2)$	Error of B_2 from Table XV	0.00011($\delta_0^2-\delta_1^2$)
$B_3\delta_{\frac{1}{2}}^3+B_4(\delta_0^4+\delta_1^4)$	Tables XVI and XVII, with mental interpolation	0.3
f_p	Final rounding error	0.5

EXAMPLES

To find (a) the right ascension of the Sun, and (b) the horizontal parallax of the Moon, at $16^{\text{h}} 23^{\text{m}} 15^{\text{s}}.8$ E. T., on 1967 October 11. The tabular values, and their differences in units of the end figure of the functions, are:

1967 R.A. of Sun				H.P. of Moon			
Oct.	h	m	s	Oct.	'	"	
10.0	12	58	57.39	11.0	57	07.784	
11.0	13	02	37.85	11.5	56	44.746	
12.0	13	06	18.76	12.0	56	23.084	
13.0	13	10	00.14	12.5	56	02.929	
			+22046			-23038	
			+44			+1185	
			+22091			+1376	
			+47			+1507	
			+22138			+1585	
			+48				

(a) The tabular interval is one day; the interpolating factor p is therefore 0.68282. From Table XIII, $B_2 = -0.054$; and

$$f_p = 13^{\text{h}} 02^{\text{m}} 37^{\text{s}}.85 + 0.68282(+220^{\text{s}}.91) - 0.054(+0^{\text{s}}.45 + 0^{\text{s}}.47) = 13^{\text{h}} 05^{\text{m}} 08^{\text{s}}.64$$

Alternatively, from Table XIV, with arguments $p = 0.68$, $\delta_0^2 + \delta_1^2 = 90$, the second-difference correction $B_2(\delta_0^2 + \delta_1^2) = -5$; and

$$f_p = 13^{\text{h}} 02^{\text{m}} 37^{\text{s}}.85 + 0.68282(+220^{\text{s}}.91) - 0^{\text{s}}.05 = 13^{\text{h}} 05^{\text{m}} 08^{\text{s}}.64$$

(b) The tabular interval is $0^{\text{s}}.5$; the interpolating factor p is therefore 0.36564. From Table XV, $B_2 = -0.0580$; from Table XVI, $B_3\delta_2^3 = +0.7$, using $p = 0.366$, $\delta_2^3 = 131$; from Table XVII, $B_4(\delta_0^4 + \delta_1^4) = -1.2$, using $p = 0.366$, $\delta_0^4 + \delta_1^4 = 113$; and

$$f_p = 56^{\circ} 44' 746'' + 0.36564(-21'' 662) - 0.0580(+1'' 376 + 1'' 507) + 0'' 0007 - 0'' 0012 = 56^{\circ} 36' 658''$$

TABLE XIII. BESSEL COEFFICIENTS B_2 , B_3 , B_4

p	B_2	p	B_2	p	B_2	p	B_2	p	B_2	p	B_3
0.0000	.000	0.1101	.025	0.2719	.050	0.7280	.049	0.8898	.024	0.0	0.000
.0020	.001	.1152	.026	.2809	.051	.7366	.048	.8949	.023	.1	+ .006
.0060	.002	.1205	.027	.2902	.052	.7449	.047	.9000	.022	.2	.008
.0101	.003	.1258	.028	.3000	.053	.7529	.046	.9049	.021	.3	.007
.0142	.004	.1312	.029	.3102	.054	.7607	.045	.9098	.020	.4	+ .004
.0183	.005	.1366	.030	.3211	.055	.7683	.044	.9147	.019	0.5	0.000
.0225	.006	.1422	.031	.3326	.056	.7756	.043	.9195	.018		
.0267	.007	.1478	.032	.3450	.057	.7828	.042	.9242	.017	.6	- .004
.0309	.008	.1535	.033	.3585	.058	.7898	.041	.9289	.016	.7	.007
.0352	.009	.1594	.034	.3735	.059	.7966	.040	.9335	.015	.8	.008
.0395	.010	.1653	.035	.3904	.060	.8033	.039	.9381	.014	.9	- .006
.0439	.011	.1713	.036	.4105	.061	.8098	.038	.9427	.013	1.0	0.000
.0483	.012	.1775	.037	.4367	.062	.8162	.037	.9472	.012		
.0527	.013	.1837	.038	.4632	.061	.8224	.036	.9516	.011	p	B_4
.0572	.014	.1901	.039	.4894	.060	.8286	.035	.9560	.010	0.0	0.000
.0618	.015	.1966	.040	.6095	.059	.8346	.034	.9604	.009	.1	+ .004
.0664	.016	.2033	.041	.6264	.058	.8405	.033	.9647	.008	.2	.007
.0710	.017	.2101	.042	.6414	.057	.8464	.032	.9690	.007	.3	.010
.0757	.018	.2171	.043	.6549	.056	.8521	.031	.9732	.006	.4	.011
.0804	.019	.2243	.044	.6673	.055	.8577	.030	.9774	.005	0.5	+0.012
.0852	.020	.2316	.045	.6788	.054	.8633	.029	.9816	.004	.6	.011
.0901	.021	.2392	.046	.6897	.053	.8687	.028	.9857	.003	.7	.010
.0950	.022	.2470	.047	.7000	.052	.8741	.027	.9898	.002	.8	.007
.1000	.023	.2550	.048	.7097	.051	.8794	.026	.9939	.001	.9	+ .004
.1050	.024	.2633	.049	.7190	.050	.8847	.025	0.9979	.000	1.0	0.000
0.1101		0.2719		0.7280		0.8898		1.0000			

In critical cases ascend.

B_2 is always negative.

TABLE XIV. SECOND-DIFFERENCE CORRECTION $B_2(\delta_0^2 + \delta_1^2)$

p	Double second difference $\delta_0^2 + \delta_1^2$																					p
	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	
0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00
.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.99
.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	.98
.03	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	.97
.04	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	.96
0.05	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.95
.06	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	.94
.07	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	.93
.08	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	.92
.09	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	.91
0.10	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	0.90
.11	0	0	0	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	3	3	.89
.12	0	0	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	.88
.13	0	0	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	.87
.14	0	0	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3	.86
0.15	0	0	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	4	0.85
.16	0	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	4	4	.84
.17	0	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	4	4	4	.83
.18	0	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	4	4	4	4	.82
.19	0	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	.81
0.20	0	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	0.80
.21	0	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	5	.79
.22	0	1	1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	5	.78
.23	0	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	.77
.24	0	1	1	1	1	2	2	2	2	3	3	3	3	3	3	4	4	4	4	5	5	.76
0.25	0	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	4	5	5	5	0.75
.26	0	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	4	5	5	5	.74
.27	0	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	4	5	5	5	.73
.28	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.72
.29	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.71
0.30	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	0.70
.31	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.69
.32	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.68
.33	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.67
.34	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.66
0.35	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	0.65
.36	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.64
.37	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.63
.38	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.62
.39	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.61
0.40	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	0.60
.41	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.59
.42	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.58
.43	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.57
.44	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.56
0.45	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	0.55
.46	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.54
.47	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.53
.48	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.52
.49	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	.51
0.50	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6	0.50

The correction has the opposite sign to $\delta_0^2 + \delta_1^2$.

TABLE XIV. SECOND-DIFFERENCE CORRECTION $B_2(\delta_0^2 + \delta_1^2)$

p	Double second difference $\delta_0^2 + \delta_1^2$																		p
	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	
0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00
.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.99
.02	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	.98
.03	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	.97
.04	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	.96
0.05	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0.95
.06	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	.94
.07	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	.93
.08	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	4	4	.92
.09	2	2	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	.91
0.10	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	0.90
.11	3	3	3	3	3	3	4	4	4	4	4	4	4	4	5	5	5	5	.89
.12	3	3	3	3	4	4	4	4	4	4	4	4	5	5	5	5	5	5	.88
.13	3	3	4	4	4	4	4	4	4	5	5	5	5	5	5	5	6	6	.87
.14	3	4	4	4	4	4	4	5	5	5	5	5	5	5	6	6	6	6	.86
0.15	4	4	4	4	4	4	5	5	5	5	5	5	6	6	6	6	6	6	0.85
.16	4	4	4	4	5	5	5	5	5	5	6	6	6	6	6	6	7	7	.84
.17	4	4	4	5	5	5	5	5	5	6	6	6	6	6	7	7	7	7	.83
.18	4	4	5	5	5	5	5	6	6	6	6	6	6	7	7	7	7	7	.82
.19	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	.81
0.20	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	0.80
.21	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	.79
.22	5	5	5	6	6	6	6	6	7	7	7	7	8	8	8	8	8	9	.78
.23	5	5	6	6	6	6	6	7	7	7	7	8	8	8	8	8	9	9	.77
.24	5	5	6	6	6	6	7	7	7	7	8	8	8	8	8	9	9	9	.76
0.25	5	6	6	6	6	7	7	7	7	8	8	8	8	8	9	9	9	9	0.75
.26	6	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	.74
.27	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	.73
.28	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	.72
.29	6	6	6	7	7	7	7	8	8	8	9	9	9	9	10	10	10	10	.71
0.30	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	0.70
.31	6	6	7	7	7	7	8	8	8	9	9	9	9	10	10	10	10	11	.69
.32	6	7	7	7	7	8	8	8	8	9	9	9	10	10	10	10	11	11	.68
.33	6	7	7	7	7	8	8	8	9	9	9	9	10	10	10	11	11	11	.67
.34	6	7	7	7	8	8	8	8	9	9	9	10	10	10	10	11	11	11	.66
0.35	7	7	7	7	8	8	8	9	9	9	9	10	10	10	11	11	11	11	0.65
.36	7	7	7	7	8	8	8	9	9	9	10	10	10	10	11	11	11	12	.64
.37	7	7	7	8	8	8	8	9	9	9	10	10	10	10	11	11	11	12	.63
.38	7	7	7	8	8	8	9	9	9	9	10	10	10	11	11	11	11	12	.62
.39	7	7	7	8	8	8	9	9	9	10	10	10	10	11	11	11	12	12	.61
0.40	7	7	7	8	8	8	9	9	9	10	10	10	10	11	11	11	11	12	0.60
.41	7	7	8	8	8	8	9	9	9	10	10	10	11	11	11	11	12	12	.59
.42	7	7	8	8	8	9	9	9	9	10	10	10	11	11	11	12	12	12	.58
.43	7	7	8	8	8	9	9	9	9	10	10	10	11	11	11	12	12	12	.57
.44	7	7	8	8	8	9	9	9	10	10	10	10	11	11	11	12	12	12	.56
0.45	7	7	8	8	8	9	9	9	10	10	10	11	11	11	11	12	12	12	0.55
.46	7	7	8	8	8	9	9	9	10	10	10	11	11	11	11	12	12	12	.54
.47	7	7	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	12	.53
.48	7	7	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	12	.52
.49	7	7	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	12	.51
0.50	7	8	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	12	0.50

If third and fourth differences are negligible $f_p = f_0 + p\delta_1 + B_2(\delta_0^2 + \delta_1^2)$.

TABLE XV. SECOND-DIFFERENCE COEFFICIENT B_2

p	B_2	p	p	B_2	p	p	B_2	p	p	B_2	p
0.000	-0.0000	1.000	0.035	-0.0084	0.965	0.070	-0.0163	0.930	0.105	-0.0235	0.895
.001	.02	.999	.036	.87	.964	.071	.165	.929	.106	.237	.894
.002	.05	.998	.037	.89	.963	.072	.167	.928	.107	.239	.893
.003	.07	.997	.038	.91	.962	.073	.169	.927	.108	.241	.892
.004	.10	.996	.039	.94	.961	.074	.171	.926	.109	.243	.891
0.005	-0.0012	0.995	0.040	-0.0096	0.960	0.075	-0.0173	0.925	0.110	-0.0245	0.890
.006	.15	.994	.041	.098	.959	.076	.176	.924	.111	.247	.889
.007	.17	.993	.042	.101	.958	.077	.178	.923	.112	.249	.888
.008	.20	.992	.043	.103	.957	.078	.180	.922	.113	.251	.887
.009	.22	.991	.044	.105	.956	.079	.182	.921	.114	.253	.886
0.010	-0.0025	0.990	0.045	-0.0107	0.955	0.080	-0.0184	0.920	0.115	-0.0254	0.885
.011	.27	.989	.046	.110	.954	.081	.186	.919	.116	.256	.884
.012	.30	.988	.047	.112	.953	.082	.188	.918	.117	.258	.883
.013	.32	.987	.048	.114	.952	.083	.190	.917	.118	.260	.882
.014	.35	.986	.049	.116	.951	.084	.192	.916	.119	.262	.881
0.015	-0.0037	0.985	0.050	-0.0119	0.950	0.085	-0.0194	0.915	0.120	-0.0264	0.880
.016	.39	.984	.051	.121	.949	.086	.197	.914	.121	.266	.879
.017	.42	.983	.052	.123	.948	.087	.199	.913	.122	.268	.878
.018	.44	.982	.053	.125	.947	.088	.201	.912	.123	.270	.877
.019	.47	.981	.054	.128	.946	.089	.203	.911	.124	.272	.876
0.020	-0.0049	0.980	0.055	-0.0130	0.945	0.090	-0.0205	0.910	0.125	-0.0273	0.875
.021	.51	.979	.056	.132	.944	.091	.207	.909	.126	.275	.874
.022	.54	.978	.057	.134	.943	.092	.209	.908	.127	.277	.873
.023	.56	.977	.058	.137	.942	.093	.211	.907	.128	.279	.872
.024	.59	.976	.059	.139	.941	.094	.213	.906	.129	.281	.871
0.025	-0.0061	0.975	0.060	-0.0141	0.940	0.095	-0.0215	0.905	0.130	-0.0283	0.870
.026	.63	.974	.061	.143	.939	.096	.217	.904	.131	.285	.869
.027	.66	.973	.062	.145	.938	.097	.219	.903	.132	.286	.868
.028	.68	.972	.063	.148	.937	.098	.221	.902	.133	.288	.867
.029	.70	.971	.064	.150	.936	.099	.223	.901	.134	.290	.866
0.030	-0.0073	0.970	0.065	-0.0152	0.935	0.100	-0.0225	0.900	0.135	-0.0292	0.865
.031	.75	.969	.066	.154	.934	.101	.227	.899	.136	.294	.864
.032	.77	.968	.067	.156	.933	.102	.229	.898	.137	.296	.863
.033	.80	.967	.068	.158	.932	.103	.231	.897	.138	.297	.862
.034	.82	.966	.069	.161	.931	.104	.233	.896	.139	.299	.861
0.035	-0.0084	0.965	0.070	-0.0163	0.930	0.105	-0.0235	0.895	0.140	-0.0301	0.860

TABLE XVI. THIRD-DIFFERENCE CORRECTION $B_3\delta_{\mathcal{M}}^3$

Interpolating factor p : correction has same sign as difference $\delta_{\mathcal{M}}^3$

$\delta_{\mathcal{M}}^3$	0.00	0.02	0.04	0.06	0.08	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.42	0.44	0.46	0.48	0.50
100	0.0	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.8	0.7	0.6	0.4	0.3	0.2	0.2	0.1	0.0
200	0.0	0.3	0.6	0.8	1.0	1.2	1.5	1.6	1.6	1.4	1.1	0.8	0.6	0.5	0.3	0.2	0.0
300	0.0	0.5	0.9	1.2	1.5	1.8	2.2	2.4	2.3	2.1	1.7	1.2	1.0	0.7	0.5	0.2	0.0
400	0.0	0.6	1.2	1.7	2.1	2.4	3.0	3.2	3.1	2.8	2.3	1.6	1.3	1.0	0.7	0.3	0.0
500	0.0	0.8	1.5	2.1	2.6	3.0	3.7	4.0	3.9	3.5	2.8	2.0	1.6	1.2	0.8	0.4	0.0
600	0.0	1.0	1.8	2.5	3.1	3.6	4.5	4.8	4.7	4.2	3.4	2.4	1.9	1.5	1.0	0.5	0.0
700	0.0	1.1	2.1	2.9	3.6	4.2	5.2	5.6	5.5	4.9	4.0	2.8	2.3	1.7	1.2	0.6	0.0
800	0.0	1.3	2.4	3.3	4.1	4.8	6.0	6.4	6.2	5.6	4.6	3.2	2.6	2.0	1.3	0.7	0.0
900	0.0	1.4	2.6	3.7	4.6	5.4	6.7	7.2	7.0	6.3	5.1	3.6	2.9	2.2	1.5	0.7	0.0
1000	0.0	1.6	2.9	4.1	5.2	6.0	7.4	8.0	7.8	7.0	5.7	4.0	3.2	2.5	1.7	0.8	0.0
	1.00	0.98	0.96	0.94	0.92	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.58	0.56	0.54	0.52	0.50

Interpolating factor p : correction has opposite sign to difference $\delta_{\mathcal{M}}^3$

$$f_p = f_o + p\delta_{\mathcal{M}} + B_2(\delta_o^2 + \delta_1^2) + B_3\delta_{\mathcal{M}}^3 + B_4(\delta_o^4 + \delta_1^4)$$

TABLE XV. SECOND-DIFFERENCE COEFFICIENT B_2

p	B_2	p	p	B_2	p	p	B_2	p	p	B_2	p
0.140	-0.0301	0.860	0.210	-0.0415	0.790	0.280	-0.0504	0.720	0.350	-0.0569	0.650
.142	305	.858	.212	418	.788	.282	506	.718	.355	572	.645
.144	308	.856	.214	421	.786	.284	508	.716	.360	576	.640
.146	312	.854	.216	423	.784	.286	511	.714	.365	579	.635
.148	315	.852	.218	426	.782	.288	513	.712	.370	583	.630
0.150	-0.0319	0.850	0.220	-0.0429	0.780	0.290	-0.0515	0.710	0.375	-0.0586	0.625
.152	322	.848	.222	432	.778	.292	517	.708	.380	589	.620
.154	326	.846	.224	435	.776	.294	519	.706	.385	592	.615
.156	329	.844	.226	437	.774	.296	521	.704	.390	595	.610
.158	333	.842	.228	440	.772	.298	523	.702	.395	597	.605
0.160	-0.0336	0.840	0.230	-0.0443	0.770	0.300	-0.0525	0.700	0.400	-0.0600	0.600
.162	339	.838	.232	445	.768	.302	527	.698	.405	602	.595
.164	343	.836	.234	448	.766	.304	529	.696	.410	605	.590
.166	346	.834	.236	451	.764	.306	531	.694	.415	607	.585
.168	349	.832	.238	453	.762	.308	533	.692	.420	609	.580
0.170	-0.0353	0.830	0.240	-0.0456	0.760	0.310	-0.0535	0.690	0.425	-0.0611	0.575
.172	356	.828	.242	459	.758	.312	537	.688	.430	613	.570
.174	359	.826	.244	461	.756	.314	539	.686	.435	614	.565
.176	363	.824	.246	464	.754	.316	540	.684	.440	616	.560
.178	366	.822	.248	466	.752	.318	542	.682	.445	617	.555
0.180	-0.0369	0.820	0.250	-0.0469	0.750	0.320	-0.0544	0.680	0.450	-0.0619	0.550
.182	372	.818	.252	471	.748	.322	546	.678	.455	620	.545
.184	375	.816	.254	474	.746	.324	548	.676	.460	621	.540
.186	379	.814	.256	476	.744	.326	549	.674	.465	622	.535
.188	382	.812	.258	479	.742	.328	551	.672	.470	623	.530
0.190	-0.0385	0.810	0.260	-0.0481	0.740	0.330	-0.0553	0.670	0.475	-0.0623	0.525
.192	388	.808	.262	483	.738	.332	554	.668	.480	624	.520
.194	391	.806	.264	486	.736	.334	556	.666	.485	624	.515
.196	394	.804	.266	488	.734	.336	558	.664	.490	625	.510
.198	397	.802	.268	490	.732	.338	559	.662	.495	625	.505
0.200	-0.0400	0.800	0.270	-0.0493	0.730	0.340	-0.0561	0.660	0.500	-0.0625	0.500
.202	403	.798	.272	495	.728	.342	563	.658	.505	625	.495
.204	406	.796	.274	497	.726	.344	564	.656	.510	625	.490
.206	409	.794	.276	500	.724	.346	566	.654	.515	624	.485
.208	412	.792	.278	502	.722	.348	567	.652	.520	624	.480
0.210	-0.0415	0.790	0.280	-0.0504	0.720	0.350	-0.0569	0.650	0.525	-0.0623	0.475

TABLE XVII. FOURTH-DIFFERENCE CORRECTION $B_4(\delta_0^4 + \delta_1^4)$ Interpolating factor p : correction has same sign as difference $(\delta_0^4 + \delta_1^4)$

$\delta_0^4 + \delta_1^4$	0.00	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.25	0.30	0.35	0.40	0.50
50	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6
100	0.0	0.1	0.2	0.2	0.3	0.4	0.5	0.5	0.6	0.7	0.7	0.9	1.0	1.1	1.1	1.2
150	0.0	0.1	0.2	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.3	1.5	1.6	1.7	1.8
200	0.0	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.2	1.3	1.4	1.7	1.9	2.1	2.2	2.3
250	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.3	1.5	1.7	1.8	2.1	2.4	2.6	2.8	2.9
300	0.0	0.2	0.5	0.7	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.6	2.9	3.2	3.4	3.5
350	0.0	0.3	0.6	0.8	1.1	1.4	1.6	1.9	2.1	2.3	2.5	3.0	3.4	3.7	3.9	4.1
400	0.0	0.3	0.6	1.0	1.3	1.6	1.8	2.1	2.4	2.6	2.9	3.4	3.9	4.2	4.5	4.7
450	0.0	0.4	0.7	1.1	1.4	1.8	2.1	2.4	2.7	3.0	3.2	3.8	4.4	4.8	5.0	5.3
500	0.0	0.4	0.8	1.2	1.6	2.0	2.3	2.7	3.0	3.3	3.6	4.3	4.8	5.3	5.6	5.9
1.00	0.98	0.96	0.94	0.92	0.90	0.88	0.86	0.84	0.82	0.80	0.75	0.70	0.65	0.60	0.50	

Interpolating factor p : correction has same sign as difference $(\delta_0^4 + \delta_1^4)$

$$f_p = f_o + p\delta_{1/2} + B_2(\delta_0^2 + \delta_1^2) + B_3\delta_{1/2}^3 + B_4(\delta_0^4 + \delta_1^4)$$

EXPLANATION

This explanation is limited to stating the precise meanings of the tabular quantities, and specifying the sources of the fundamental tables and constants used in calculating them. Complete explanations of the ephemerides and their computation are contained in a separate volume, *Explanatory Supplement to The Astronomical Ephemeris and The American Ephemeris and Nautical Almanac*, published by H. M. Stationery Office, London; it includes the formulae and the auxiliary tables with which the computations are made, and numerical examples of all the calculations.

Beginning with the volume for 1960, the tabular argument in the fundamental ephemerides of the Sun, Moon, and planets is Ephemeris Time; in nearly all of the other ephemerides, the argument is Universal Time. Ephemeris Time is the uniform measure of time defined by the laws of dynamics and determined in principle from the orbital motions of the planets, specifically the *orbital motion of the Earth* as represented by NEWCOMB's *Tables of the Sun*. Universal Time is defined by the *rotational motion of the Earth*, and is determined from the apparent diurnal motions which reflect this rotation; because of variations in the rate of the rotation, Universal Time is not rigorously uniform.

Ephemeris Time is the independent variable in the gravitational theories of the Sun, Moon, and planets. The Ephemeris Time at any instant is obtained from observation by directly comparing observed positions of the Sun, Moon, and planets with gravitational ephemerides of their coordinates; observations of the Moon are the most effective and expeditious for this purpose. An accurate determination, however, requires observations over a more or less extended period; in practice, it takes the form of determining the correction ΔT that must be applied to Universal Time to obtain Ephemeris Time:

$$\text{E.T.} = \text{U.T.} + \Delta T.$$

The Universal Time at any instant may be obtained with little delay from observations of the diurnal motions; it is the basis of civil timekeeping, and is the standard in astronomical observation and in the applications of astronomy to navigation and surveying. Ephemeris Time is the standard for purposes that require a strictly uniform measure. In order to provide a *relatively* uniform measure without delay, determinations of Universal Time, beginning with 1956, have been corrected for the variation of the meridian due to the observed motion of the geographic poles, and for the extrapolated annual variation in the rate of rotation of the Earth; the corrected value is distinguished by the notation UT2.

The numerical measure in which Ephemeris Time is reckoned is defined by the apparent *annual motion of the Sun in longitude*. Universal Time, in

principle, is determined by the *average* rate of the apparent *diurnal motion of the Sun relative to the meridian of Greenwich*; but in practice, the numerical measure of Universal Time at any instant is computed from a conventional relation to the measure of time defined by the diurnal motion of the equinox or First Point of Aries, known as *sidereal time*. The sidereal time at any instant may be rapidly and accurately determined from observations of the diurnal motions of stars.

The sidereal time is numerically measured by the hour angle of the equinox, which represents the position of the equinox in its diurnal circuit. The period of one diurnal circuit of the equinox in hour angle, between two consecutive upper meridian transits, is a sidereal day; it is divided into 24 sidereal hours, reckoned from 0^h at upper transit which is known as sidereal noon. The *true* equinox is at the intersection of the true equator of date with the ecliptic of date; the time measured by its diurnal motion is *apparent sidereal time*. The position of the true equinox is affected by the nutation of the axis of rotation of the Earth; and the nutation consequently introduces irregular periodic inequalities into the apparent sidereal time and the length of the sidereal day. The time measured by the diurnal motion of the *mean* equinox of date, which is affected only by the secular inequalities due to the precession of the axis, is *mean sidereal time*. Apparent sidereal time minus mean sidereal time is the *equation of the equinoxes* due to the nutation; in the volumes immediately preceding 1960, it was designated as the nutation in right ascension, and was included in the ephemeris of the Sun.

Universal Time is a particular case of the measure known in general as *mean solar time*. This measure is defined in principle by the apparent diurnal motion of a conventional fiducial point located on the mean celestial equator of date, and characterized by a uniform sidereal motion along the equator at a rate which only differs from the mean rate of the annual motion of the Sun along the ecliptic by the amount of the slight secular acceleration of the Sun. Relative to any meridian of longitude, this point has a diurnal motion in hour angle virtually the same as the average diurnal motion of the Sun, and with only very slight inequalities due to variations of the local meridian and variations of the rate of rotation of the Earth. The measure known as local mean solar time is derived from this fiducial point; but since the abstract point is not actually observable, the definition is formulated as a relation to sidereal time, and in practice mean solar time is obtained through this intermediary. Universal Time is the mean solar time on the Greenwich meridian, reckoned in days of 24 mean solar hours beginning with 0^h at midnight.

The relation that defines the numerical measure of mean solar time is derived from the position adopted for the fiducial point relative to the equinox, which is represented by a conventional formula for its right ascension. The practice in the past has been to adopt for the right ascension an expression as nearly identical with the expression for the mean longitude of the Sun on the ecliptic as is possible, consistent with a sidereal motion at a constant rate. Due to the secular acceleration of the Sun and to the different secular accelerations of the equinox on the ecliptic and the equator, the position in right ascension

differs from the mean longitude of the Sun in Newcomb's *Tables* by only a slight progressively increasing excess of $0^{\circ}0203 T^2$, where T is the number of centuries after 1900. The position in hour angle is never more than about 16^m from the Sun. This point, abstractly defined by the conventional expression for its right ascension, has therefore traditionally been called the fictitious mean sun. Its right ascension fixes its position among the stars at every instant, and is a means of exactly defining a measure of mean solar time by a relation to the sidereal time obtained from the observable diurnal motions of the stars.

This relation that defines mean solar time is expressed as a numerical formula for the sidereal time on the Greenwich meridian at the instant of mean midnight; the sidereal time calculated from this formula is the Greenwich hour angle of the equinox that defines 0^h U.T. and enables this instant to be identified by observation. The formula that is in established use was derived by adding 12^h to NEWCOMB's expression for the right ascension of the fictitious mean sun; the mean sidereal time at 0^h U.T. of any calendar date is the numerical value of the resultant quantity

$$6^h 38^m 45^s.836 + 86 40184^s.542 T + 0^s.0929 T^2,$$

calculated with the value of T that denotes the number of Julian centuries of 36525 days which, at the midnight beginning the day, have elapsed since mean noon on 1900 January 0 at the Greenwich meridian. The instant at which the mean equinox reaches the Greenwich hour angle calculated from this formula is designated 0^h U.T. Each mean solar day is the period of time between the two instants at which the equinox reaches the hour angles calculated with the two values of the parameter T at an interval of $1/36525$ which denote consecutive dates.

Prior to the recognition of variations in the rotation of the Earth, mean midnight was considered to be the instant of lower meridian transit of the fictitious mean sun, since the formula is numerically the same as the expression for the right ascension of the fictitious mean sun increased by 12^h . However, as a consequence of the variations in rotation, the motion of the equinox in hour angle is slightly irregular; but meanwhile, the rate of motion of the fictitious mean sun relative to the equinox is completely independent of the variable rotation of the Earth, and consequently the actual right ascension plus 12^h does not reach the value calculated from a given value of T at exactly the same instant as does the hour angle of the equinox. The instant when the equinox reaches the calculated hour angle is midnight by definition; but the formula which represents the hour angle does not represent the right ascension of the mean sun plus 12^h for *this same instant*, and this additional designation previously often used for the sidereal time of 0^h has been eliminated from the ephemerides.

The sidereal and the mean solar measures are affected proportionally by the variations of the rotation; their ratio is a fixed constant, and the mean solar day is proportional to the period of rotation. The mean solar time at any instant on any meridian is determined from the observed local sidereal time at this instant by means of the constant ratio of the mean solar to the

sidereal measure, and the ephemeris of *Universal and Sidereal Times* on pages 10–17. The tabular sidereal times on successive dates are the Greenwich hour angles of the equinox that determine the instants of successive Greenwich mean midnights. At the instant of any observed Greenwich sidereal time, the interval which has elapsed since 0^h U.T., expressed in sidereal units, is immediately obtained by subtracting the tabular sidereal time at 0^h U.T. from the observed sidereal time at the instant. The Universal Time at the instant is the equivalent measure of this interval in units of mean solar time; it is obtained by multiplying the sidereal measure by the constant 0.99726 95664 which represents the ratio of the sidereal day to the mean solar day. The definition and practical determination of Universal Time were not affected by the introduction of Ephemeris Time in 1960, and the numerical reckoning was continued without discontinuity except for increased precision due to improved values of the nutation.

The ratio of the mean solar day to the mean sidereal day is 1.00273 79093, and the equivalent measures of the length of the day are:

Mean sidereal day . . . 23^h 56^m 04^s.09054 of mean solar time

Mean solar day 24^h 03^m 56^s.55536 of mean sidereal time

From these equivalents, Tables VIII and IX have been constructed for converting intervals of time from one measure to the other. To the order of accuracy of 0.01, these tables may be used for either mean or apparent sidereal time; but in more precise calculations, separate account must be taken of the equation of the equinoxes.

Calendar (Pages 1–3)

Over extended intervals, civil time is ordinarily reckoned according to conventional calendar years and adopted historical eras; in constructing and regulating civil calendars, and fixing ecclesiastical calendars, a number of auxiliary cycles and periods are used. The principal chronological eras and cycles are listed on page 1; and the Gregorian calendar for the current year is given on pages 2–3.

In astronomical practice prior to 1925, mean solar time was reckoned from noon instead of from midnight. The mean solar day beginning at noon, 12 hours *after* the midnight at the beginning of the same civil date, is known as the astronomical day. To facilitate chronological reckoning, the astronomical days beginning at Greenwich noon are numbered consecutively, from an epoch sufficiently far in the past to precede the historical period; the number which denotes a day in this continuous count is the Julian Day Number. The Julian Day reckoning begins with Julian Day Number 0 for January 1, 4713 B.C., Julian proleptic calendar; the Julian Day Number therefore denotes the length of time that has elapsed, at Greenwich noon at the beginning of the astronomical day, since this epoch. The Julian Day Numbers for the current year are given in the calendar; from Table I they may be found for other years up to A.D. 2300, and it is readily apparent how this table may be extended over any interval.

Dates expressed in Julian Days and fractions of a day represent time elapsed at the instant. In several of the ephemerides in this volume, the arguments are designated by the Julian Dates in addition to the Gregorian calendar dates. On pages where the argument is Ephemeris Time, the Julian Date, like the calendar date, refers to ephemeris days; but the Julian Day begins at 12^h E.T., the calendar day at 0^h E.T. The terminology *Julian Ephemeris Date* may be used to distinguish the Julian Date with the day beginning at 12^h E.T. instead of at 12^h U.T. (Greenwich Mean Noon), when it is essential to avoid ambiguity, as in dating orbital elements, or in formulae for light curves of variable stars, where the time must be given to a large number of decimals of a day.

The period of one complete circuit of the fictitious mean sun in right ascension, beginning at the instant when the right ascension is 18^h 40^m, is known as the Besselian solar year, and is an advantageous unit of time for some astronomical purposes. In 1967, the beginning of the Besselian year is January 1^d 041 Ephemeris Time; this instant is denoted by the notation 1967.0, and is given at the foot of each page of the calendar. Because of the secular excess of the right ascension of the fictitious mean sun over the mean longitude of the Sun, the Besselian year is shorter than the tropical year by the amount 0^s.148 *T*, where *T* denotes the time in centuries after 1900.

Phenomena (Pages 4–9)

The principal configurations of the Sun, Moon, and planets with one another during the year, and other phenomena of general interest, are listed on these pages.

The *Diary* on pages 5–7 contains, in chronological order with times to the nearest hour: the geocentric phenomena also given on page 4; occultations of the four bright stars *Aldebaran*, *Regulus*, *Spica*, and *Antares*, and of planets, for which, if any occur, another table is given on page 5 that includes the area of visibility, the tabular times being for geocentric conjunction in right ascension; and the dates of the eclipses and transits that occur during the year, for which the areas of visibility are indicated at the bottom of page 4. In addition, the *Diary* includes the phases of the Moon, and apogee and perigee of the Moon; the closest approach of Mars to the Earth, when the geocentric distance passes through a minimum; geocentric conjunctions in apparent right ascension of the planets with the Moon, with one another, and with the bright stars *Aldebaran*, *Pollux*, *Regulus*, *Spica*, and *Antares*, except when these phenomena occur within 24 hours of New Moon or within 10° of the Sun; and the geocentric phenomena of Ceres, Pallas, Juno, and Vesta, for which the dates alone are given at the bottom of page 8. The magnitudes and elongations from the Sun on every fifth day for the inferior planets and every tenth day for the superior planets, and approximate visual magnitudes of the minor planets Ceres, Pallas, Juno, and Vesta at 40-day intervals, are tabulated on pages 8–9. Revised values for the magnitudes of the minor planets were adopted, beginning with 1962.

The geocentric phenomena differ from the actually observed configurations by the effects of the geocentric parallax at the place of observation, which for configurations with the Moon may be quite large. The tabular times for the stationary points of the planets are the instants at which the planet is stationary in *apparent* geocentric right ascension; but for the elongations of the planets from the Sun, the tabular times are for the *geometric* configurations. The times of conjunction and opposition are, respectively, the instants when the apparent geocentric longitude of the planet differs by 0° and 180° from the geocentric longitude of the Sun. From inferior conjunction to superior conjunction of Mercury or Venus, or from conjunction to opposition of a superior planet, the elongation from the Sun is west; from superior to inferior conjunction, or from opposition to conjunction, the elongation is east. Because of the difference in latitude, the elongations do not in general pass through 0° or 180° as they change from west to east or from east to west. The tabular times of the greatest elongations of Mercury and Venus are the instants when the true geocentric angular distance from the Sun is a maximum.

The times of the equinoxes and solstices, which on page 4 are given to the nearest minute of Universal Time, are the instants when the apparent longitude of the Sun is a multiple of 90° .

The times given for the greatest brilliancy of Venus are the instants at which the value of the expression

$$\frac{(r + \Delta - R)(r + \Delta + R)}{r^3 \Delta^3}$$

is a maximum, where r and R denote, respectively, the heliocentric distances of Venus and the Earth, and Δ is the geocentric distance of Venus.

The heliocentric phenomena for which dates are given on page 4 are the perihelion and aphelion, the passages through the nodes on the ecliptic, and the greatest north and south heliocentric latitudes, in the actual disturbed motion. Because of perturbations, the dates are not in general the same as the dates that would be obtained from the elements of the mean orbit; the date on which the radius vector is a minimum may differ considerably from the date on which the heliocentric longitude of the planet is equal to the longitude of the perihelion of the mean orbit, and similarly the heliocentric longitude of the planet when its heliocentric latitude becomes zero may differ from the longitude of the mean node. At the ascending node, the planet passes through the plane of the ecliptic from south to north, and the heliocentric latitude vanishes in changing from negative to positive; at the descending node, the latitude changes from positive to negative as the planet passes through the plane of the ecliptic from north to south.

Universal and Sidereal Times (Pages 10–17)

The sidereal time (Hour Angle of First Point of Aries) at 0^h Universal Time, and the Universal Time at 0^h sidereal time (Transit of First Point of Aries), are tabulated both for the mean equinox of date, and for the true equinox

with the short-period terms of nutation included. In the ephemeris of sidereal time at 0^h U.T., the argument is the calendar date and the equivalent Julian Date. In the ephemeris of Universal Time at 0^h sidereal time on each day, the argument is the Greenwich Sidereal Date, defined as the number of sidereal days, determined by the equinox of date, that have elapsed at Greenwich since the beginning of the sidereal day which was in progress at J.D. 0.0. The integral part of the Greenwich Sidereal Date is called the Greenwich Sidereal Day Number; it is a means of consecutively numbering the successive sidereal days beginning at the *transits* of the First Point of Aries, similar to the Julian Day reckoning of the successive mean solar days beginning at the instants of the *tabular hour angles* of the First Point of Aries. The Greenwich Sidereal Day is the number of sidereal days that have elapsed at 0^h Greenwich sidereal time since the Greenwich sidereal 0^h that immediately preceded J.D. 0.0; the zero day is the sidereal day that was in progress at the beginning of the Julian Era.

From these ephemerides for the meridian of Greenwich, the local mean time on any meridian of longitude may be calculated from the local sidereal time, or conversely. For this purpose, the longitude is expressed in time. The measure of longitude in arc may be converted to the equivalent measure in time by Table XII; the reverse transformation is obtained by Table XI.

The longitude expressed in time and reckoned positive westward is numerically the amount by which Universal Time is greater than the local mean solar time at the same instant. At the instant when the local mean time is 0^h, the longitude is therefore the measure of the interval of mean solar time that has elapsed at Greenwich since 0^h U.T.; and adding the equivalent measure of this mean solar interval in units of sidereal time to the Greenwich sidereal time at 0^h U.T. gives the sidereal time at Greenwich at the instant when the mean solar time on the *local* meridian is 0^h. Like the mean solar times, the Greenwich sidereal time is greater than the local sidereal time at the *same* instant by the amount of the longitude; and therefore the *local* sidereal time at 0^h local mean solar time is obtained directly by adding to the tabular Greenwich sidereal time at the *previous* instant of 0^h U.T. the same *correction* as required to convert the mean solar interval measured by the longitude into an equivalent sidereal interval. This reduction may either be taken from Table IX, or obtained by means of the hourly variation +9^s8565.

Similarly, the Universal Time of Greenwich sidereal 0^h may be reduced to the local mean solar time of 0^h local sidereal time at any longitude by applying the correction from Table VIII, or by means of the hourly variation -9^s8296.

Conversion of sidereal time to mean solar time

On 1967 July 7, at approximately 4^h local mean solar time, in longitude 85° 15' west (+ 5^h 41^m), the observed apparent sidereal time is 23^h 02^m 11^s.724. The Universal Time at this instant is approximately 10^h; the equation of the

equinoxes is therefore -0^s530 , and subtracting this amount from the observed sidereal time gives the local mean sidereal time.

	h	m	s
Greenwich mean sidereal time, 0 ^h U.T., July 7	18	57	06.235
Reduction for longitude (Table IX).			+ 56.018
Mean sidereal time, 0 ^h local mean solar time.	18	58	02.253
Local mean sidereal time at observation.	23	02	12.254
Sidereal interval since 0 ^h local mean solar time.	4	04	10.001
Reduction to mean solar interval (Table VIII).			- 40.001
Local mean solar time.	4	03	30.000

If the sidereal interval is less than $3^m 56^s5$, there are two mean solar times corresponding to the sidereal time, one a few minutes after the preceding 0^h, and the other a few minutes before the following 0^h, at a mean solar time interval of about $23^h 56^m 04^s$. The approximate mean solar time always determines which one is to be taken. Any local sidereal time within an interval of less than $3^m 56^s5$ after 0^h local mean solar time will occur a second time on the same mean solar day; the subtraction of the local sidereal time of 0^h from either of these two sidereal times will give the same numerical result, but the actual interval for the second value is 24 sidereal hours greater.

The conversion of sidereal time to mean solar time may also be made by adding to the mean solar time of the *preceding* local sidereal 0^h the equivalent of the sidereal time in units of mean solar time.

Conversion of mean solar time to sidereal time

To convert mean solar time to mean sidereal time, add to the local mean sidereal time at 0^h the equivalent measure of the local mean solar time in sidereal units. To obtain the apparent sidereal time, add further the equation of the equinoxes, interpolated to the time. As an example, on 1967 July 7, in longitude $85^\circ 15'$ west ($+5^h 41^m$), at $4^h 03^m 30^s$ local mean solar time, to determine the local sidereal time:

	h	m	s
Greenwich mean sidereal time, 0 ^h U.T., July 7	18	57	06.235
Reduction for longitude (Table IX).			+ 56.018
Local mean solar time	4	03	30.000
Reduction of local mean time to sidereal interval			+ 40.001
Local mean sidereal time	23	02	12.254
Equation of the equinoxes, July 7 ^d 406 U.T.			- 0.530
Local apparent sidereal time.	23	02	11.724

Sun, Moon, and Planets

In the fundamental ephemerides, except where otherwise stated, the tabular positions are *apparent* positions, i.e., the positions in which the Sun, Moon,

and planets would actually be seen from the center of the Earth at the tabular times, displaced by planetary aberration and referred to the coordinate systems determined by the instantaneous equator, ecliptic, and equinox, with Ephemeris Time as the argument; the value used for the light-time at unit distance is $498^{\text{s}}.38$, corresponding to the adopted constant of aberration. For comparison with photographic observations, *astrometric* positions are given for Pluto and the minor planets; for the latter they are included with the apparent positions. Ephemerides that are intended for theoretical purposes, where a fixed reference system is needed, are referred to the *fixed equinox* of a convenient epoch; and Tables III and IV are for facilitating reductions from one equinox to another.

The tabular quantities at instants other than the tabular times may be obtained by interpolation with the requisite order of differences. For this purpose, differences are included in many of the ephemerides; and Tables XIII–XVII may be used for interpolation.

The ephemerides are computed strictly from the tables to which references are made, and with the standard values that are stated for the fundamental constants. In accordance with resolutions of the International Astronomical Union, no corrections are applied to bring the tables into better accord with later observations, and no change has been made in the conventionally adopted value of any fundamental constant that was used in the volumes immediately preceding 1960. Tabular values, when taken from the same tables, are unaltered by the adoption of Ephemeris Time, but the tabular argument is correctly designated as Ephemeris Time instead of Universal Time.

Meridian transits, transit ephemerides and other phenomena that depend upon hour angles and geographic location, when calculated from the fundamental ephemerides by the same procedures as used prior to 1960, are referred, not to the Greenwich meridian and to Universal Time, but to a meridian $1.002738 \Delta T$ east of the geographic meridian of Greenwich, and to Ephemeris Time. This slightly different meridian is known as the *ephemeris meridian*; to facilitate the calculation of phenomena that depend upon the rotation of the Earth, it is used as an auxiliary reference meridian. Hour angles and longitudes reckoned from the ephemeris meridian are distinguished by the terms *ephemeris hour angle* and *ephemeris longitude*. The ephemeris hour angle of the equinox is called *ephemeris sidereal time*.

The *ephemeris transit* is the Ephemeris Time at the instant of transit across the *ephemeris meridian*. Interpolation to any local meridian by using the ephemeris longitude as the interpolating factor gives the Ephemeris Time of local transit across this meridian; in forming first differences of the tabular ephemeris transits for this purpose, it must not be overlooked that the *day* is part of each tabular time. At ephemeris transit, the ephemeris sidereal time is equal to the right ascension.

When referred to the ephemeris meridian, phenomena depending on the rotation of the Earth may be calculated in terms of Ephemeris Time by methods which formally are exactly the same as the procedures for calculations referred

to the Greenwich meridian in terms of Universal Time. The practical calculations are based on the principle that the tabular Greenwich sidereal time of 0^h U.T. is numerically equal to the ephemeris sidereal time of 0^h E.T.; that is, the equinox at 0^h E.T. is at the same hour angle from the ephemeris meridian as it is from the Greenwich meridian at 0^h U.T.

Until ΔT is known, local hour angles referred to a specific meridian of *geographic* longitude cannot be calculated; but the ephemeris longitude where the actual local hour angle has any particular value may be determined entirely in terms of Ephemeris Time, and this procedure is followed in predictions of the general circumstances of eclipses. As soon as ΔT becomes known, the longitudes may be referred to the Greenwich meridian, and the Universal Times when the hour angle has the given values at these geographic longitudes may be determined.

For the computation of ephemerides with Universal Time as the argument, the value of ΔT is specifically required. Since ΔT depends primarily upon the *irregular* variations in the rate of rotation of the Earth, it cannot be determined in advance with certainty and exactness, or incorporated in the tables, but must be separately applied as determined from time to time by actual observation. Since ephemerides must be computed several years in advance, those that have the argument Universal Time are necessarily based upon an extrapolated value of ΔT . However, the uncertainty of the extrapolation, over the relatively short intervals necessary, is within the order of accuracy to which these ephemerides are calculated; in practice, to the degree of precision needed, the ephemerides are for the most part unchanged by a transformation of the argument from Ephemeris Time to Universal Time.

Values of ΔT as determined from discussions of observations are tabulated on page vii, together with estimated values for several later years.

The method of converting an ephemeris from Ephemeris Time to Universal Time depends upon whether hour angles are involved in the computation of the tabular quantities. When the tabular values are independent of the rotation of the Earth, an ephemeris for 0^h Ephemeris Time may be converted to an ephemeris for 0^h Universal Time by interpolating the tabular values to an interval ΔT after 0^h Ephemeris Time; if second differences are negligible, the interpolated values are obtained by adding algebraically to each of the tabular values for 0^h Ephemeris Time the correction $\frac{\Delta T}{h} \delta_{1/2}$, where h is the tabular interval and $\delta_{1/2}$ denotes the first difference.

The Universal Time of transit of the Sun, Moon, or a planet across the meridian of Greenwich may be found by subtracting ΔT from the Ephemeris Time of Greenwich transit that is obtained by interpolating the ephemeris transit from the geographic longitude of the ephemeris meridian, 1.002738 ΔT east, to longitude 0°. The ephemeris transit is the time on the Greenwich meridian at the instant of transit across the ephemeris meridian; the Greenwich transit follows ephemeris transit at an interval which to a first approximation exceeds

ΔT by the time equivalent of the motion in right ascension during the interval ΔT . The Universal Time of Greenwich transit is, therefore, algebraically greater than the tabular ephemeris transit by approximately the amount $\frac{\Delta T}{h} \delta_{\frac{1}{2}} \alpha$.

Fundamental Units and Astronomical Constants

Time, Mass, and Length

The fundamental epoch from which Ephemeris Time is reckoned is the epoch that NEWCOMB designated as 1900 January 0, Greenwich Mean Noon, but which actually is 1900 January 0^d 12^h E.T.; the instant to which this designation is assigned is the instant near the beginning of the calendar year A. D. 1900 when the geometric mean longitude of the Sun referred to the mean equinox of date was 279°41'48".04 (*Trans. Int. Astr. Union*, vol. X, 1960, pages 72, 500). Ephemeris Time is the measure of time in which NEWCOMB's *Tables of the Sun* agree with observation.

The primary unit of Ephemeris Time is the tropical year, defined by the mean motion of the Sun in longitude at the epoch 1900 January 0^d 12^h E.T.; its length in ephemeris days is determined by the coefficient of T in NEWCOMB's expression for the geometric mean longitude of the Sun, L , referred to the mean equinox of date, given among the elements of the Sun. The *ephemeris second* is defined as 1/31556925.9747 of the tropical year for 1900 January 0^d 12^h E.T.; it has been formally adopted as the fundamental invariable unit of time by the Comité International des Poids et Mesures (*Procès-Verbaux des Séances*, deuxième sér. xxv, 77, 1957). The ephemeris day is 86400 ephemeris seconds. The former fundamental unit of time was the mean solar second, defined as 1/86400 of the mean solar day.

In the astronomical system of measures, the usual unit of time is the ephemeris day. The fundamental unit of mass is the mass of the Sun. The unit of length is the astronomical unit, defined as the unit of distance in terms of which, in KEPLER's Third Law $n^2 a^3 = k^2 (1 + m)$, the semimajor axis a of an elliptic orbit must be expressed in order that the numerical value of the Gaussian constant k may be exactly 0.01720209895 when the unit of time is the ephemeris day (*Trans. Int. Astr. Union*, vol. VI, 1939, pages 20, 336, 357); in astronomical units, the mean distance of the Earth from the Sun, calculated by KEPLER's Law from the observed mean motion n and adopted mass m , is 1.0000 0003 (NEWCOMB).

Constants

Gaussian Constant of Gravitation $k = 0.01720\ 20989\ 50000$
 $= 3548''.18760\ 69651$ (Int. Astr. Union)

Solar Parallax	8".80	} Paris Conference, 1896
Constant of Nutation	9.21	
Constant of Aberration	20.47	

Velocity of light 299 860 km/sec = 186 324 statute miles/sec

(NEWCOMB and MICHELSON, *Astr. Pap. Amer. Eph.*, II, 202, 1891)

Equation of light

From constant of aberration 498^s38From velocity of light and solar parallax 498^s58*International Ellipsoid of Reference* (Bull. Géodésique, 1925, page 555)*Flattening $f = 1/297 = 0.003\ 367\ 003\ 367\ 003\ 367$ *Equatorial Radius $a = 6378\ 388\ \text{m}$ Polar Radius $a(1-f) = 6356\ 911.946\ \text{m}$ Square of eccentricity $e^2 = 0.006\ 722\ 670\ 022\ 333\ 322$ Reduction from geodetic latitude ϕ to geocentric latitude ϕ'

$$\phi' - \phi = -11' 35''.6635 \sin 2\phi + 1''.1731 \sin 4\phi - 0''.0026 \sin 6\phi$$

Radius vector

$$\rho = a(0.998\ 320\ 047 + 0.001\ 683\ 494 \cos 2\phi - 0.000\ 003\ 549 \cos 4\phi + 0.000\ 000\ 008 \cos 6\phi)$$

One degree of latitude (m)

$$111\ 136.54 - 562.21 \cos 2\phi + 1.18 \cos 4\phi \quad (\phi = \text{mid-latitude of arc})$$

One degree of longitude (m)

$$111\ 417.66 \cos \phi - 93.90 \cos 3\phi + 0.12 \cos 5\phi$$

*Normal Gravity (cm/sec²)

$$g = 978.0490 (1 + 0.0052\ 884 \sin^2 \phi - 0.0000\ 059 \sin^2 2\phi)$$

Free-air gravity correction, cm/sec², at an elevation (in m) of H

$$- (0.0003\ 0855 + 0.0000\ 0022 \cos 2\phi) H + 0.0000\ 72 (H/1000)^2$$

Length of seconds pendulum (m)

$$0.9935\ 882 - 0.0026\ 203 \cos 2\phi + 0.0000\ 029 \cos 4\phi$$

*Adopted values, from which other quantities are derived.

Annual rates of precession (NEWCOMB, *Astr. Pap. Amer. Eph.*, VIII, 73, 1897)General precession $p = 50''.2564 + 0''.0222\ T$ Planetary precession $\lambda' = 0''.1247 - 0''.0188\ T$ Lunisolar precession $\psi = 50''.3708 + 0''.0050\ T$ Precession in right ascension $m = 3''.07234 + 0''.00186\ T$ Precession in declination $n = 20''.0468 - 0''.0085\ T$

The time T is measured in tropical centuries from 1900.0. The values of p , m , and n at the beginning of the Besselian solar year are given on page 50.

These *rates* of the precessional motions at a particular epoch must be carefully distinguished from the accumulated *amounts* of the motions over an extended interval of time, and the consequent displacements of the coordinate systems which the precessional motions produce. The amount of the precession in right ascension during the interval of time from t_0 to t is $\zeta_0 + z$, where $90^\circ - \zeta_0$ is the right ascension of the ascending node of the mean equator at time t on the mean equator of t_0 reckoned from the mean equinox of t_0 , and $90^\circ + z$ is the right ascension of the node reckoned from the mean equinox of t ; the amount of the precession in declination is the inclination θ of the mean equator

at time t to the mean equator of t_0 . For $t_0 = 1950.0$, with the interval of time T from this epoch measured in tropical centuries,

$$\begin{aligned}\zeta_0 &= +2304''.948 \ T + 0''.302 \ T^2 + 0''.0179 \ T^3, \\ z &= +2304''.948 \ T + 1''.093 \ T^2 + 0''.0192 \ T^3, \\ \theta &= +2004''.255 \ T - 0''.426 \ T^2 - 0''.0416 \ T^3.\end{aligned}$$

Interchanging t_0 with t replaces ζ_0 by $-z$, and z by $-\zeta_0$, and changes the sign of θ .

On page 50, the numerical values are given for these precessional displacements of the mean equator and mean equinox during the interval between 1950.0 and the beginning of the current year; and Table III contains values for other intervals. Over a short interval, the values of $\zeta_0 + z$ and θ may be obtained from the rates m and n of the precessions at the *midpoint of the interval*, by the formulae

$$M = m(t_0 - t), \quad N = n(t_0 - t).$$

Similarly, the amounts of the general precession in longitude a , and rotation of the ecliptic b , may be calculated from the rate of precession p , and speed of rotation of the ecliptic π , at the midpoint of the interval, by

$$a = p(t_0 - t), \quad b = \pi(t_0 - t).$$

The numerical values of these quantities for the interval between 1950.0 and the current year, and of

$$c = 180^\circ - \Pi + \frac{1}{2}a$$

where Π is the longitude of the axis of rotation of the ecliptic at the midpoint of the interval, are also given on page 50, with formulae for calculating the corresponding precessional variations of equatorial and ecliptic coordinates, and of the ecliptic elements Ω , i , ω , of an orbit. Expressions for calculating π and Π at any date are given among the elements of the Sun.

Nutation

The formulae adopted for computing the nutation in longitude and obliquity are obtained by retaining all terms with coefficients as great as $0''.0002$ from the expressions developed in *Astr. Pap. Amer. Eph.*, vol. XV, Part I, page 153, 1953; they are given in *Astr. Jour.*, 58, 2, 1953, and in the *Explanatory Supplement*.

The effects of short-period terms, defined as terms with periods of less than 35 days, are fully included in the ephemerides of the Sun, Moon, and planets.

Sun (Pages 18–50)

The ephemerides of the Sun are derived from the geometric longitude referred to the mean equinox of date, the latitude referred to the ecliptic of date, the logarithm of the radius vector, and the mean obliquity of date, that

are taken from NEWCOMB'S *Tables of the Sun, Astr. Pap. Amer. Eph.*, vol. VI, Part I, 1895. The mean orbital elements on which these tables are based, with T denoting the time measured in Julian centuries of 36525 ephemeris days from the epoch, and d the time in ephemeris days, are:

Epoch 1900 January 0.5 E.T. = J.D. 241 5020.0

Geometric mean longitude, mean equinox of date

$$L = 279^\circ 41' 48''.04 + 1296\ 02768''.13 T + 1''.089 T^2 \\ = 279^\circ 69668 + 0^\circ 98564\ 73354 d + 0''.000303 T^2$$

Mean longitude of perigee, mean equinox of date

$$\Gamma = 281^\circ 13' 15''.0 + 6189''.03 T + 1''.63 T^2 + 0''.012 T^3 \\ = 281^\circ 22083 + 0''.00004\ 70684 d + 0''.000453 T^2 + 0''.000003 T^3$$

Mean anomaly, $L - \Gamma$

$$g = 358^\circ 28' 33''.0 + 1295\ 96579''.10 T - 0''.54 T^2 - 0''.012 T^3 \\ = 358^\circ 47583 + 0^\circ 98560\ 02670 d - 0''.000150 T^2 - 0''.000003 T^3$$

Eccentricity

$$e = 0.01675\ 104 - 0.00004\ 180 T - 0.00000\ 0126 T^2$$

The principal related auxiliary constants are:

Mean obliquity of the ecliptic

$$\epsilon = 23^\circ 27' 08''.26 - 46''.845 T - 0''.0059 T^2 + 0''.00181 T^3 \\ = 23^\circ 452294 - 0''.01301\ 25 T - 0''.00000\ 164 T^2 + 0''.00000\ 0503 T^3$$

Annual rate of rotation of ecliptic $\pi = 0''.4711 - 0''.0007 T$

Longitude of axis of rotation $\Pi = 173^\circ 57'.06 + 54'.77 T$

Lengths of the years

$$\text{Tropical} \quad 365^{\text{d}}\ 2421\ 9879 - 0^{\text{d}}0000\ 0614 T \\ 365^{\text{d}}\ 05^{\text{h}}\ 48^{\text{m}}\ 46^{\text{s}}.0 - 0^{\text{s}}.530 T$$

$$\text{Sidereal} \quad 365^{\text{d}}\ 2563\ 6042 + 0^{\text{d}}0000\ 0011 T \\ 365^{\text{d}}\ 06^{\text{h}}\ 09^{\text{m}}\ 09^{\text{s}}.5 + 0^{\text{s}}.01 T$$

$$\text{Anomalistic} \quad 365^{\text{d}}\ 2596\ 4134 + 0^{\text{d}}0000\ 0304 T \\ 365^{\text{d}}\ 06^{\text{h}}\ 13^{\text{m}}\ 53^{\text{s}}.0 + 0^{\text{s}}.26 T$$

$$\text{Eclipse} \quad 346^{\text{d}}\ 6200\ 31 + 0^{\text{d}}0000\ 32 T \\ 346^{\text{d}}\ 14^{\text{h}}\ 52^{\text{m}}\ 50^{\text{s}}.7 + 2^{\text{s}}.8 T$$

The longitude of the axis of rotation of the ecliptic is for the extremity that is at the ascending node of the instantaneous position of the ecliptic on the immediately preceding position; and it is referred to the mean equinox of date. The position of the ecliptic in terms of its inclination π_1 and node Π_1 on the fixed ecliptic of the epoch is represented by

$$\pi_1 \sin \Pi_1 = + 4''.964 T + 0''.1939 T^2 - 0''.00019 T^3, \\ \pi_1 \cos \Pi_1 = - 46''.845 T + 0''.0545 T^2 + 0''.00035 T^3.$$

The values of L and g for every tenth day, the values of Γ and e at the beginning of the calendar year, and of π , Π , and ϵ and the trigonometric functions of ϵ for the beginning of the Besselian year, are given on page 50.

The geocentric spherical coordinates of the Sun are tabulated in the ephemeris on pages 18–33. The geocentric equatorial rectangular coordinates are given on pages 34–49, referred to the mean equator and equinox of both the beginning of the year and 1950.0; the dates in bold-face type are the standard 10-day ephemeris dates recommended by the International Astronomical Union, for which the integral part of the Julian Day Number is divisible by 10. The positive X -axis is directed toward the equinox, the Y -axis toward the point on the equator at right ascension 6^h , and the Z -axis toward the north pole of the equator.

The tabular longitude is the geometric longitude referred to the mean equinox of the beginning of the Besselian year; it may be reduced to the fixed mean equinox of 1950.0 by applying the correction given in the footnote. The values of the latitude referred both to the ecliptic of the beginning of the year and to the fixed ecliptic of 1950.0 are tabulated, in addition to the latitude referred to the ecliptic of date.

The precession in longitude is the amount of the precessional displacement of the equinox along the ecliptic since the beginning of the Besselian year. Adding it to the tabular longitude gives the geometric longitude referred to the mean equinox of date, which may be further reduced to the true equinox of date by adding the nutation in longitude. The nutation includes short-period terms.

The reduction to apparent longitude is the sum of the nutation in longitude at date and the precession from the beginning of the year to date, diminished by aberration which is calculated by dividing $20''.47$ by the radius vector.

The horizontal parallax is the angle subtended at the Sun by the equatorial radius of the Earth; the tabular values are calculated by dividing $8''.80$ by the radius vector.

The apparent right ascension and declination are referred to the true equinox and equator of date, and are affected by aberration. They are calculated from the geometric longitude, the latitude referred to the ecliptic of date, and the tabular obliquity of date, which is the sum of the mean obliquity and the nutation in obliquity inclusive of short-period terms; they are corrected for aberration by antedating for the light-time. The value of the radius vector is geometric, not affected by aberration.

The tabular semidiameter includes an allowance for irradiation, and is obtained by dividing an enhanced value of the semidiameter at unit distance by the radius vector, although actually the irradiation does not depend upon the distance; the value adopted for the enhanced semidiameter at unit distance is $16' 01''.18$.

Moon (Pages 51–159)

The lunar ephemeris is calculated directly from BROWN'S theory instead of from his *Tables of the Motion of the Moon*; but in order to obtain a strictly gravitational ephemeris expressed in the same measure of time as defined by

NEWCOMB'S *Tables of the Sun*, the orbital elements upon which BROWN'S tables are based are amended by removing the empirical term and by applying to the mean longitude the correction

$$- 8''.72 - 26''.74 T - 11''.22 T^2,$$

where T is measured in Julian centuries from 1900 January 0.5 E.T. = J.D. 2415020.0.

Denoting by d the number of ephemeris days from the epoch, the fundamental orbital constants are

$$\begin{aligned}\mathcal{C} &= 270^\circ 26' 02''.99 + 1336' 307^\circ 52' 59''.31 T - 4''.08 T^2 + 0''.0068 T^3 \\ &= 270^\circ 434164 + 13^\circ 17639 \ 65268 d - 0^\circ 001133 T^2 + 0^\circ 0000019 T^3, \\ \Gamma' &= 334^\circ 19' 46''.40 + 11' 109^\circ 02' 02''.52 T - 37''.17 T^2 - 0''.045 T^3 \\ &= 334^\circ 329556 + 0^\circ 11140 \ 40803 d - 0^\circ 010325 T^2 - 0^\circ 000012 T^3, \\ \Omega &= 259^\circ 10' 59''.79 - 5' 134^\circ 08' 31''.23 T + 7''.48 T^2 + 0''.008 T^3 \\ &= 259^\circ 183275 - 0^\circ 05295 \ 39222 d + 0^\circ 002078 T^2 + 0^\circ 000002 T^3, \\ e &= 0.05490 \ 0489, \\ \gamma &= 0.04488 \ 6967, \\ \text{Constant of sine parallax, } &3422''.5400,\end{aligned}$$

where γ is the sine of half the inclination to the ecliptic, e denotes the eccentricity, and

- \mathcal{C} , the mean longitude of the Moon, measured in the ecliptic from the mean equinox of date to the mean ascending node of the lunar orbit, and then along the orbit;
- Γ' , the mean longitude of the lunar perigee, measured in the ecliptic from the mean equinox of date to the mean ascending node of the lunar orbit, and then along the orbit;
- Ω , the longitude of the mean ascending node of the lunar orbit on the ecliptic, measured from the mean equinox of date.

The equatorial horizontal parallax at distance 60.2665 equatorial radii of the Earth is $57' 02''.70$.

In the lunar theory, the adopted ratio of the mass of the Earth to the mass of the Moon is 81.53.

The mean elongation of the Moon from the Sun is

$$\begin{aligned}D &= 350^\circ 44' 14''.95 + 1236' 307^\circ 06' 51''.18 T - 5''.17 T^2 + 0''.0068 T^3 \\ &= 350^\circ 737486 + 12^\circ 19074 \ 91914 d - 0^\circ 001436 T^2 + 0^\circ 0000019 T^3.\end{aligned}$$

The lengths of the months for the epoch 1900 are

	d	d	h	m	s
Synodic	29.530 589	29	12	44	02.9
Tropical	27.321 582	27	07	43	04.7
Sidereal	27.321 661	27	07	43	11.5
Anomalistic	27.554 551	27	13	18	33.2
Draconitic	27.212 220	27	05	05	35.8

The secular variations do not exceed a few hundredths of a second per century, and depend partly upon the variations in the rate of rotation of the Earth.

The values of Γ' , Ω , ζ , and D for every tenth day are tabulated on page 51. This page also contains, for every tenth day, the values of

i , the inclination of the mean equator of the Moon to the true equator of the Earth,

Δ , the arc of the mean equator of the Moon from its ascending node on the true equator of the Earth to its ascending node on the ecliptic of date,

Ω' , the arc of the true equator of the Earth from the true equinox of date to the ascending node of the mean equator of the Moon,

calculated with HARN'S value of $1^\circ 32'.1$ for the inclination of the mean lunar equator to the ecliptic; the ascending node of the mean lunar equator on the ecliptic is at the descending node of the mean lunar orbit, $\Omega \pm 180^\circ$.

The longitude referred to the mean equinox of date, the latitude referred to the ecliptic of date, and the horizontal parallax (pages 52–67) are computed for every half-day from BROWN'S theoretical expressions, with the corrections required for the amendment to the mean longitude. The apparent longitude and latitude are obtained by adding the nutation in longitude and some residual effects of aberration not included in BROWN'S expressions. (*Astr. Jour.*, **57**, 46, 1952).

The semidiameter, s , is derived from the horizontal parallax, π , by the formula

$$s = 0''.0796 + 0.272446 \pi,$$

the constants in which are based on NEWCOMB'S value of $15' 32''.58$ for the semidiameter at mean distance (Researches on the Motion of the Moon, Part II, *Astr. Pap. Amer. Eph.*, vol. IX, 39, 1912). No correction is made for irradiation.

The apparent right ascension and declination for each hour of Ephemeris Time (pages 68–159) are calculated for 0^h and 12^h from the apparent longitude, the apparent latitude, and the true obliquity of date; and for the other hours by interpolation.

Page 159 contains the phases of the Moon, and the times of perigee and apogee or least and greatest distances from the Earth. The times of New Moon, First Quarter, Full Moon and Last Quarter are the times at which the excess of the apparent longitude of the Moon over the apparent longitude of the Sun is 0° , 90° , 180° , and 270° , respectively. The lunations are numbered in continuation of E. W. BROWN'S series, of which No. 1 commenced on 1923 January 16 (*Mon. Not. Roy. Astr. Soc.*, **93**, 603, 1933).

The Planets (Pages 160–257)

The orbital longitudes and the heliocentric ecliptic longitudes referred to the mean equinox of date, the heliocentric latitudes referred to the ecliptic

of date, and the radii vectores of the *inner planets* Mercury, Venus, and Mars are taken from NEWCOMB'S tables in *Astr. Pap. Amer. Eph.*, vol. VI, Parts II, III, IV, 1895-1898; for Mars, the corrections derived by Ross, *Astr. Pap. Amer. Eph.*, vol. IX, Part II, 1917, are applied. The orbital elements are for the mean orbits. For Venus and Mars, the latitude referred to the mean orbit, due to periodic perturbations in latitude, is included in the heliocentric ephemerides.

The ephemerides of the *outer planets* Jupiter, Saturn, Uranus, Neptune, and Pluto, are computed from the heliocentric rectangular coordinates obtained by numerical integration in *Astr. Pap. Amer. Eph.*, vol. XII, 1951. Perturbations by the inner planets, taken from *Astr. Pap. Amer. Eph.*, vol. XIII, Part V, 1954, are included in the geocentric ephemerides, but are omitted from the heliocentric ephemerides, and from the heliocentric orbital elements. The elements are for the osculating orbits.

In these ephemerides, the adopted masses of the planets and the formulae for the mean elements of the inner planets are given in the *Explanatory Supplement*.

The geocentric ephemerides are calculated from the heliocentric coordinates of the planets and the geocentric coordinates of the Sun. The *apparent* right ascension and declination are referred to the true equator and equinox of date, inclusive of the short-period terms of nutation; and they have been corrected for planetary aberration.

The *astrometric* positions of Pluto and the minor planets are obtained by adding the planetary aberration to the geometric ephemeris referred to a standard mean equinox such as that of 1950.0, and then subtracting stellar aberration, calculated by the conventional formula which neglects the part depending on the longitude of the perihelion of the Earth. The astrometric ephemeris is therefore rigorously comparable with observations that are referred to catalogue mean places of comparison stars (corrected for proper motion and annual parallax, if significant, to the epoch of observation), it being only necessary to correct the observations for geocentric parallax.

The tabular true distance from the Earth is the actual geocentric distance at the tabular time, *not* at the instant when the light that reaches the observer at the tabular time left the planet.

The horizontal parallax is $8''.80$ divided by the geocentric distance. The tabular semidiameter is the value at unit distance divided by the geocentric distance; the adopted semidiameters at unit distance are:

Mercury	3''.34	Saturn:	
Venus	8''.41	Equatorial	83''.33
Mars.	4''.68	Polar	74''.57
Jupiter:		Uranus	34''.28
Equatorial	98''.47	Neptune	36''.56
Polar.	91''.91		

The authorities for these values are given in the *Explanatory Supplement*.

The ephemerides of the minor planets Ceres, Pallas, Juno, and Vesta are computed from heliocentric rectangular coordinates calculated by PAUL HERGET, *Astr. Pap. Amer. Eph.*, vol. XVI, Part III, 1962.

The ephemerides are in the same form as for Pluto, with the addition of the reductions from astrometric to apparent right ascension and declination. Daily positions are given for the periods during which the planet is more than about 40° from the Sun. Since accurate observations of the minor planets may lead to an improved value for the mass of the Moon, the dates on which the lunar inequality is a maximum in right ascension are indicated by an asterisk. The magnitudes are *photographic*; revised values were adopted, beginning with 1962.

Stars

The star places that are given in this volume are limited to the mean places of the brighter stars at the beginning of the Besselian year, to an accuracy of $0^s.1$ in right ascension and $1''$ in declination. However, the volume contains all the data necessary for the accurate reduction of precise star places from one epoch to another, or from mean place to apparent place. Examples of these reductions are given in the *Explanatory Supplement*.

Day Numbers (Pages 258–281)

The Besselian Day Numbers and the Independent Day Numbers are given for 0^h Ephemeris Time, with the sidereal time to the nearest tenth of an hour to assist in determining the interpolating factor for the time of meridian transit of a star. They are followed by the Besselian Day Numbers at 0^h Greenwich sidereal time; these are derived quantities, and the third decimal is uncertain by one unit.

From these Day Numbers, the reduction from mean place to apparent place for precession, nutation, and aberration is obtained to the first order. The additional Day Numbers necessary to determine the reduction to the second order, tabulated separately for northern and southern declinations, are given on pages 278–281.

To avoid a second-order reduction as far as possible, the Day Numbers are referred to the *nearest* beginning of a year, instead of always to the beginning of the current year. For any tabular date, τ denotes the fraction of a tropical year that has elapsed since the date to which the tabular values of the Day Numbers are referred; and the apparent place is obtained with these Day Numbers from the mean place at the beginning of either the *current* Besselian year or the *next following* year, according to the tabular value of τ . In consequence, all the Day Numbers except *B* and *E* are discontinuous at the middle of the year; for July 1 and 2, values are given for both epochs. By not extending the reduction over more than half a year,

the second-order reduction and the error from neglecting it are kept as small as practicable.

The reductions to the second order, including the proper motion, are

$$\begin{aligned}\alpha &= \alpha_0 + \tau\mu_\alpha + Aa + Bb + Cc + Dd + E + J \tan^2 \delta_0 \\ &= \alpha_0 + \tau\mu_\alpha + f + g \sin (G + \alpha_0) \tan \delta_0 + h \sin (H + \alpha_0) \sec \delta_0 + J \tan^2 \delta_0, \\ \delta &= \delta_0 + \tau\mu_\delta + Aa' + Bb' + Cc' + Dd' + J' \tan \delta_0 \\ &= \delta_0 + \tau\mu_\delta + g \cos (G + \alpha_0) + h \cos (H + \alpha_0) \sin \delta_0 + i \cos \delta_0 + J' \tan \delta_0,\end{aligned}$$

where zero subscripts denote the mean place, and

$$\begin{aligned}a &= \frac{m}{n} + \sin \alpha_0 \tan \delta_0, & a' &= \cos \alpha_0, \\ b &= \cos \alpha_0 \tan \delta_0, & b' &= -\sin \alpha_0, \\ c &= \cos \alpha_0 \sec \delta_0, & c' &= \tan \epsilon \cos \delta_0 - \sin \alpha_0 \sin \delta_0, \\ d &= \sin \alpha_0 \sec \delta_0, & d' &= \cos \alpha_0 \sin \delta_0,\end{aligned}$$

which are known as the Besselian Star Constants. Additional corrections for parallax may be obtained from

$$\begin{aligned}\Delta\alpha &= \pi (cY - dX), \\ \Delta\delta &= \pi (c'Y - d'X),\end{aligned}$$

where X, Y are the coordinates of the Sun and c, d, c', d' are the Besselian Star Constants. In the case of binary stars, a correction for orbital motion may be necessary. The tabular values of the Day Numbers A, B, C, D, g, h, i , are in seconds of arc; when used for reducing right ascension, either they or the Star Constants by which they are multiplied must be divided by 15 to express the reduction in seconds of time.

The Besselian Day Numbers A, B , and E , or the Independent Day Numbers f, g , and G , give the reduction for precession and nutation. The short-period terms of nutation in longitude and obliquity, $d\psi$ and $d\epsilon$, respectively, and the Day Numbers f', g', G' , for obtaining the effects of these terms alone, are also tabulated. The Day Numbers f', g', G' are defined as:

$$\begin{aligned}f' &= +d\psi \cos \epsilon \\ g' \sin G' &= -d\epsilon \\ g' \cos G' &= +d\psi \sin \epsilon\end{aligned}$$

The Day Numbers C and D , or H, h , and i , give the reduction for aberration; they are derived from the actual disturbed velocity of the Earth referred to the center of mass of the solar system.

The Besselian Day Numbers are the most expeditious means of reduction when several apparent positions of the same star are required, or when the values of the Besselian Star Constants are already available; otherwise, the Independent Day Numbers are the more convenient.

Reductions for precession and nutation directly from the standard equinox of 1950.0 to the true equinox of date may be obtained with sufficient accuracy for a finding ephemeris of a comet or a minor planet by means of Table IV, in accordance with the formulae at the foot of the table. The tabular dates are the midnights following an integral Julian Date that is exactly divis-

ible by 10, in accordance with the resolutions of the International Astronomical Union that the osculation epochs of elements of comets and minor planets should be Julian Dates with the integral part divisible by 400, and that ephemerides should be for 10-day intervals. Dates followed by an asterisk are the Julian Dates with integral part divisible by 40.

To facilitate the reduction of observations in which the differences of right ascension and declination between two celestial objects are measured, the differential aberration and the differential precession and nutation may be determined from Tables V and VI in accordance with the precepts given with the tables. With the position of a star reduced to the equinox of 1950.0, or to the equinox of the nearest beginning of a year, the coordinates of an object referred to the same equinox are obtained by adding to the coordinates of the star the observed differences in the sense "object minus star", and the differential aberration, precession, and nutation taken from these tables.

Mean Places of Stars (Pages 282-292)

Mean places at the beginning of the Besselian year are tabulated for 1078 stars, including stars to a limiting magnitude 4.75 excepting 8 stars each within 30" of an included star; variable stars are in general included if the maximum is brighter than magnitude 4.7. The positions are taken from the Albany *General Catalogue of 33342 Stars for the Epoch 1950, 1937*. Beginning with 1965, the stars are tabulated in the order of their mean right ascensions at the epoch 1970.0. In the name of the star, the three-letter abbreviations for constellation names recommended by the International Astronomical Union are used; a list of these abbreviations is given in the *Explanatory Supplement*.

Disregarding proper motion, which is generally much less than a second of arc per year, the mean places at other epochs may be obtained by a reduction for precession alone. In particular, to obtain the mean place at the beginning of the next following year, which is required for calculating reductions from mean to apparent places with the tabular Day Numbers during the latter half of the current year, add to the tabular coordinates the reductions

$$\begin{aligned}\Delta\alpha &= m + n \sin \alpha \tan \delta, \\ \Delta\delta &= n \cos \alpha,\end{aligned}$$

where the values of m and n are taken from page 50. Formulae and constants for the reduction of right ascension and declination, and of longitude and latitude, for precession from the beginning of the current year to 1950.0 and in the reverse direction, are also given on page 50; and an extended tabulation of the equatorial precessional constants for other intervals is given in Table III.

Table III contains the reduction constants ζ_0 , z , and θ for rigorous trigonometric reductions of mean places to the beginning of the current year from the beginning of each fifth previous year back to 1755; and also the coefficients M and N for approximate reductions with the formulae on page 50. The table is calculated from formulae derived from NEWCOMB's numerical expressions for the precessional displacements of the mean equator, *Astr. Pap. Amer. Eph.*,

vol. VIII, page 75, 1897; M and N are obtained from the rates of change of $z + \zeta_0$ and θ at the time midway from t_0 to t . With the tabular constants, rigorous reductions of the coordinates α_0, δ_0 , referred to the mean equinox of t_0 , to the coordinates α, δ , referred to the mean equinox of the beginning of the current year, may be calculated from the formulae

$$\begin{aligned} q &= \sin \theta [\tan \delta_0 + \cos (\alpha_0 + \zeta_0) \tan \tfrac{1}{2} \theta], \\ \tan (\Delta\alpha - \mu) &= \frac{q \sin (\alpha_0 + \zeta_0)}{1 - q \cos (\alpha_0 + \zeta_0)}, \\ \mu &= \zeta_0 + z, \\ \alpha &= \alpha_0 + \Delta\alpha, \\ \tan \tfrac{1}{2} (\delta - \delta_0) &= \tan \tfrac{1}{2} \theta \sec \tfrac{1}{2} (\Delta\alpha - \mu) \cos [(\alpha_0 + \zeta_0) + \tfrac{1}{2} (\Delta\alpha - \mu)]. \end{aligned}$$

Eclipses (Pages 293–299)

Elements and general circumstances are given for all solar and lunar eclipses, including penumbral lunar eclipses, which occur during the year. For solar eclipses, maps are given from which approximate local circumstances may be obtained for any particular place; and the Besselian elements are tabulated at 10-minute intervals for the calculation of accurate predictions for any point on or above the surface of the Earth. For total or annular eclipses the latitudes and longitudes of points on the central line and on the northern and southern limits, together with the duration of the total or annular phase and the altitude of the Sun on the central line, are tabulated at intervals of five minutes or less throughout the eclipse. For lunar eclipses, the circumstances and their Ephemeris Times or Universal Times are the same for all parts of the Earth; any particular phase is visible from the hemisphere over which the Moon is then above the horizon.

The elements and circumstances are computed in accordance with BESSEL'S method, for the International Ellipsoid, from apparent right ascensions and declinations of the Sun and Moon which include the short-period terms of nutation; and the coordinates of the Sun for this purpose are calculated to an additional decimal. The semidiameters of the Sun and Moon used in the calculation of eclipses do not include irradiation. The adopted semidiameter of the Sun at unit distance is $15' 59''.63$ (AUWERS, *Astronomische Nachrichten*, 3068, 367, 1891), the same, except for irradiation, as in the ephemeris of the Sun. In calculating the duration of *total* solar eclipses on the central line, the apparent semidiameter of the Moon is obtained by putting its sine equal to $0.272274 \sin \pi$, where π is the horizontal parallax; but beginning with 1963, the adopted semidiameter of the Moon in *all other eclipse calculations* is $0.272446 \pi + 0''.079$. To obtain the tabular duration of the total phase, the correction $+0.000 207$ must be applied to the tabular radius of the umbra.

In the calculation of lunar eclipses, the radius of the geometric shadow of the Earth is increased by one-fiftieth part to allow for the effect of the atmos-

phere. Otherwise, refraction is neglected in computing solar and lunar eclipses. The Besselian elements do not involve refraction. The circumstances of eclipses are calculated for the surface of the ellipsoid, and the inclusion of refraction in them would be inappropriate. For local predictions, corrections for refraction are unnecessary; they are required only in precise comparisons of theory with observation, in which many other refinements are also necessary.

The magnitude of a solar eclipse is the fraction of the solar diameter obscured by the Moon at greatest phase, measured along the common diameter. The magnitude of a lunar eclipse is the fraction of the lunar diameter obscured by the shadow of the Earth at greatest phase, measured along the common diameter.

On the solar eclipse maps, the curves drawn in long dashes indicate the times halfway between first and last contacts of the penumbra. These times of the middle of the eclipse should not be confused with the times of greatest eclipse, from which they may differ by several minutes. The curves drawn in short dashes give the semiduration of the partial phase. The Ephemeris Times of first and last contacts are derived from the time of middle by respectively subtracting and adding the semiduration. The curves are extended across the rising and setting limits of the eclipse, although part of the phenomenon occurs below the horizon for observers in those regions.

The Besselian elements characterize the geometric position of the shadow of the Moon relative to the Earth. The exterior tangents to the surfaces of the Sun and the Moon form the umbral cone, the interior tangents the penumbral cone. The common axis of the two cones is the axis of the shadow. The geocentric plane perpendicular to the axis of the shadow is called the fundamental plane, and is taken as the xy -plane of a system of geocentric rectangular coordinates. The x -axis is the intersection of the fundamental plane with the plane of the equator, and is directed positively toward the east; the y -axis is directed positively toward the north. The z -axis is parallel to the axis of the shadow, and is positive toward the Moon. The tabular x and y are the coordinates of the intersection of the axis of the shadow with the fundamental plane, in units of the equatorial radius of the Earth. The declination d and ephemeris hour angle μ of the point on the celestial sphere toward which the axis of the shadow is directed represent the direction of the axis.

The radius of the penumbral cone on the fundamental plane is denoted by l_1 ; the radius of the umbral cone is l_2 , and is regarded as positive for an annular eclipse, negative for a total eclipse. The angles f_1 and f_2 are the angles which the elements of the penumbral and the umbral cones, respectively, make with the axis of the shadow.

To predict accurate local circumstances, calculate the geocentric coordinates $\rho \sin \phi'$ and $\rho \cos \phi'$ from the geodetic latitude ϕ and longitude λ , with Table VII; the inclusion of the elevation above sea level in this calculation is all that is necessary to obtain the local circumstances at high altitudes or in the ionosphere. Obtain approximate times for the beginning, middle, and end of the eclipse from the eclipse map; and for each of these three times, take from the table of Besselian elements the values of x , y , $\sin d$, $\cos d$, μ ,

and l_1 , except that for the middle l_2 is needed instead of l_1 where the eclipse is total or annular. The hourly variations x' , y' , of x and y are needed, and may be obtained with sufficient accuracy by multiplying the first differences of the tabular values by 6.

For each of the three approximate times, calculate the coordinates ξ , η , ζ of the observer, and the hourly variations ξ' , η' , from

$$\begin{aligned}\xi &= \rho \cos \phi' \sin h, \\ \eta &= \rho \sin \phi' \cos d - \rho \cos \phi' \sin d \cos h, \\ \zeta &= \rho \sin \phi' \sin d + \rho \cos \phi' \cos d \cos h, \\ \xi' &= \mu' \rho \cos \phi' \cos h, \\ \eta' &= \mu' \xi \sin d - \zeta d',\end{aligned}$$

where

$$h = \mu - \lambda - 1.0027 \Delta T.$$

Next, calculate

$$\begin{aligned}u &= x - \xi, & u' &= x' - \xi', \\ v &= y - \eta, & v' &= y' - \eta', \\ L &= l - \zeta \tan f, & n^2 &= u'^2 + v'^2, & (n > 0) \\ \Delta &= \frac{1}{n} (uv' - u'v), & D &= uu' + vv', \\ \sin \psi &= \frac{\Delta}{L}.\end{aligned}$$

Neglecting the variation of L , the correction τ to the assumed time of middle to obtain the *Ephemeris Time of greatest phase* is

$$\tau = -\frac{D}{n^2},$$

which may be expressed in minutes by multiplying by 60.

The correction τ to the assumed times of beginning, middle and end to obtain the *Ephemeris Times of contacts* is

$$\tau = \frac{L}{n} \cos \psi - \frac{D}{n^2},$$

which may be expressed in minutes by multiplying by 60.

The ambiguity in the quadrant of ψ is removed by noting that $\cos \psi$ must be negative for the beginning of the eclipse, for the beginning of the annular phase, and for the end of the total phase, and that $\cos \psi$ must be positive for the end of the eclipse, the end of the annular phase and the beginning of the total phase.

If the eclipse is partial at the place, the quantities l_2 , L_2 and $\sin \psi$ will not be needed for the time of middle.

For greater accuracy, the times resulting from the calculation outlined above should be taken in place of the original approximate times, and a second approximation performed.

The adopted value of ΔT must be subtracted from the final times to obtain the Universal Times of contacts and greatest phase.

The *magnitude of greatest partial eclipse*, in units of the solar diameter, is

$$M_1 = \frac{L_1 - \Delta}{2L_1 - 0.5464},$$

where the absolute value of Δ is used.

The *magnitude of the central phase*, in the same units, is

$$M_2 = \frac{0.5464}{2L_1 - 0.5464}.$$

In order to obtain the *position angle of a point of contact*, calculate the angle N defined by

$$\cot N = \frac{v'}{u'},$$

$\sin N$ having the same algebraic sign as u' . The position angle P of the point of contact, reckoned from the north point of the solar limb toward the east, is

$$P = N + \psi,$$

where the results of the final approximation are used.

The position angle V of the point of contact, reckoned from the vertex of the solar limb toward the east is

$$V = P - C,$$

where C , the parallax angle, is obtained with sufficient accuracy from

$$\tan C = \frac{\xi}{\eta},$$

$\sin C$ having the same algebraic sign as ξ , and the results of the final approximation again being used.

At any locality within several miles of a point for which the preceding computation has been made, the Ephemeris Times of the phases may be obtained by computing differential corrections in which most of the necessary numerical quantities are already available from the previous calculations. Examples illustrating the calculation of the local circumstances of partial, total, and annular eclipses, and the calculation of differential corrections, are given in the *Explanatory Supplement*.

Ephemerides for Physical Observations

The ephemerides for physical observations of the Sun, Moon, and planets are based on the fundamental ephemerides in the preceding part of the volume, and on the additional data to which specific references are made. The tabular values are affected by aberration, and should therefore be interpolated to the actual time of observation; but they are strictly geocentric. They are given to a degree of accuracy sufficient for the reduction of observations; any significant approximations made in their calculation are stated.

The value of the light-time for unit distance used in calculating the physical ephemerides is 498^s.58, corresponding to the adopted values of the solar parallax and velocity of light. The stellar magnitudes of the planets are obtained from the formulae of G. MÜLLER, *Publicationen des Astrophysikalischen Observatoriums zu Potsdam*, 8, 366, 1893; the diameters of the planets are calculated from the same semidiameters at unit distance as in the fundamental ephemerides.

Ephemeris for Physical Observations of the Sun (Pages 300–305)

This ephemeris is calculated from the elements determined by CARRINGTON, *Observations of the Spots on the Sun*, 1863, pages 221, 244:

Inclination of the solar equator to the ecliptic, $7^{\circ} 15'$;

Longitude of the ascending node of the solar equator on the ecliptic,
 $73^{\circ} 40' + 50''.25 t$, where t is the time in years reckoned from 1850;

Sidereal period of rotation, 25.38 mean solar days.

In the ephemeris, P denotes the position angle of the northern extremity of the axis of rotation, measured eastward from the north point of the disk; B_0 , the heliographic latitude, and L_0 , the heliographic longitude, of the central point of the disk. Heliographic longitudes on the surface of the Sun are measured from the solar meridian that passed through the ascending node of the solar equator on the ecliptic on 1854 January 1, Greenwich mean noon (J. D. 239 8220.0); they are reckoned from 0° to 360° , in the direction of rotation, i. e., westward on the apparent disk as viewed on the celestial sphere. CARRINGTON'S zero meridian passed the ascending node twelve hours earlier.

The synodic period of rotation is the interval of time during which L_0 decreases by 360° . The *mean* synodic period is $27^d 2753$. The beginning of each synodic rotation is the instant at which L_0 passes through 0° ; the rotations are numbered in continuation of CARRINGTON'S Greenwich photo-heliographic series, of which No. 1 commenced on 1853 November 9.

In computing the physical ephemeris of the Sun, no allowance for the secular motion of the ecliptic is made in the values of the elements; and the latitude of the Sun is neglected. No correction is applied to L_0 for rotation during the light-time, since presumably it is already included in CARRINGTON'S meridian; CARRINGTON, in reducing his observations, *added* $20''$ for aberration to the tabular longitude of the Sun taken from the *Nautical Almanac*, but he appears to have referred his measurements to the *apparent* central point of the disk. By using the apparent longitude of the Sun in calculating the physical ephemeris, the aberration in longitude is included. No further correction for aberration is required.

Ephemeris for Physical Observations of the Moon (Pages 306–313)

In the computation of this ephemeris, the formulae and constants for the physical librations, and the value $1^{\circ} 32'.1$ for the inclination of the mean lunar equator to the ecliptic, that were determined by HAYN, *Abh. d. Math.-phys. Kl. d. K. Sächs. Ges. d. Wiss.*, XXX, page 49, 1907, have been used. The ephemeris is calculated from the apparent coordinates of the Moon and the Sun, and therefore aberration is fully included, excepting the inappreciable difference between the light-time from the Sun to the Moon and from the Sun to the Earth.

The *Age* is the number of days elapsed since the previous New Moon. The *Fraction Illuminated* is the fraction of the area of the lunar disk that is illuminated, and is equal to the illuminated fraction of the diameter perpendicular to the line of cusps.

On the surface of the Moon, selenographic longitudes are measured from the lunar meridian that passes through the mean central point of the visible disk, positive in the direction towards *Mare Crisium*, i. e., towards the west on the celestial sphere. Selenographic latitudes are reckoned positive towards the north limb; that is, they are positive in the hemisphere containing *Mare Serenitatis*. The mean central point of the disk is defined as the point on the lunar surface where the surface is intersected by the radius of the Moon that would be directed towards the center of the Earth, were the Moon to be at the mean ascending node when the node coincided with either the mean perigee or mean apogee.

The tabular selenographic longitude and latitude of the Earth are the geocentric selenographic coordinates of the apparent central point of the disk; at this point on the surface of the Moon, the Earth is in the selenocentric zenith. These coordinates are the sums of the geocentric optical and physical librations in longitude and latitude respectively. When the libration in longitude, or selenographic longitude of the Earth, is positive, the mean central point of the disk is displaced eastward on the celestial sphere, exposing to view a region on the west limb. When the libration in latitude, or selenographic latitude of the Earth, is positive, the mean central point of the disk is displaced towards the south, and a region on the north limb is exposed to view.

The selenographic coordinates of the point on the lunar surface where the Sun is in the selenocentric zenith are the selenographic longitude and latitude of the Sun. Subtracting the selenographic longitude of the Sun from 90° or 450° gives the selenographic *colongitude* of the Sun tabulated in the ephemeris; numerically, it is the *east* selenographic longitude of the morning terminator, and is therefore approximately 270° , 0° , 90° , and 180° at New Moon, First Quarter, Full Moon and Last Quarter, respectively. The longitude of the evening terminator differs by 180° from that of the morning terminator.

The position angle of the axis is the angle that the lunar meridian through the apparent central point of the disk towards the north lunar pole forms with the declination circle through the central point, reckoned eastward from the north point of the disk.

The column headed *Position Angle-Bright Limb* contains the position angles of the midpoint of the illuminated limb, reckoned eastward from the north point of the disk. The position angle of the terminator, defined as the position angle of the northern cusp, always lies between -90° and $+90^\circ$; before Full Moon it is 90° greater, after Full Moon 90° less, than the position angle of the midpoint of the bright limb.

For precise reductions of observations, the tabular librations and position angles of the axis should be reduced to topocentric values. For this purpose, the following differential corrections may be used (ATKINSON, *Mon. Not. Roy. Astr. Soc.*, **111**, 448, 1951). The geocentric zenith distance of the Moon, z , the parallactic angle Q , and the topocentric parallax π' are calculated from the geocentric right ascension, declination, and parallax of the Moon, the latitude ϕ of the observer, and the local sidereal time, with the following formulae,

where h is the local hour angle of the Moon and either of the two formulae for Q may be used:

$$\begin{aligned}\cos z &= \sin \phi \sin \delta + \cos \phi \cos \delta \cos h, \\ \sin Q &= \sin h \cos \phi \operatorname{cosec} z, \\ \cos Q &= \frac{\sin \phi - \cos z \sin \delta}{\sin z \cos \delta}, \\ \pi' &= \pi (\sin z + 0.0084 \sin 2z).\end{aligned}$$

The corrections to the tabular selenographic longitude l and latitude b of the Earth and the position angle C of the axis are

$$\begin{aligned}\Delta l &= -\pi' \sin (Q - C) \sec b, \\ \Delta b &= +\pi' \cos (Q - C), \\ \Delta C &= +\sin (b + \Delta b) \Delta l - \pi' \sin Q \tan \delta.\end{aligned}$$

The tabular values should be interpolated to the time of observation with second differences.

Disks of Mercury and Venus (Pages 314–315)

The phase, k , is the ratio of the area of the illuminated portion of the apparent disk to the area of the entire apparent disk regarded as circular.

The phase angle, i , is the planetocentric angle between the Sun and the Earth.

The angle Θ is the position angle of the midpoint of the bright limb, measured eastward from the north point of the disk.

The quantity L , conventionally called the brilliancy of the disk, is the numerical value of ks^2/r^2 , where r is the radius vector from the Sun to the planet in astronomical units, s is the apparent semidiameter in seconds of arc, and ks^2 is the illuminated area of the apparent disk in units of a circular area $1''$ in apparent semidiameter. To derive the actual brightness or stellar magnitude, L must be modified by an empirical function of the phase angle; L is a measure only of the brightness which, if there were no dependence of apparent albedo on phase angle, would be determined by the area illuminated, and the relative intensity of the incident light per unit area which varies as $1/r^2$.

Ephemerides for Physical Observations of Mars, Jupiter, and Saturn (Pages 316–331)

These ephemerides give the time required for light to travel from the planet to the Earth, and the stellar magnitude and apparent diameter of the planet; and for the illuminated disk they give the position angle of the point of greatest defect of illumination, measured eastward from the north point of the disk, and the angular amount of the defect; the planetocentric angle i between the Sun and the Earth is also tabulated. In the ephemeris for Mars, the ratio k of the area of the illuminated apparent disk to the area of the entire apparent disk regarded as circular is included.

For Mars and Jupiter, quantities are given which determine the geocentric and heliocentric aspects of the planetographic coordinate systems on the surface of the planet, to which the markings on the disk are referred. The aspect

of the disk depends upon the positions of the Earth and the Sun relative to the different areas of the surface of the planet, or equivalently upon the apparent positions of the Earth and the Sun on the planetocentric celestial sphere at the different points of the surface. To represent these positions, coordinate systems are defined on the planetocentric sphere, by the plane of the equator of the planet and the plane of its orbit, in the same way as right ascension and declination, and celestial longitude and latitude, are defined on the geocentric celestial sphere by the equator of the Earth and the ecliptic. Because of the mathematically indefinite radius of the celestial sphere, the same fundamental reference circles are defined on the geocentric sphere as on the planetocentric sphere by the orbital and equatorial planes of the Earth and the other planets.

On a planetocentric sphere, the apparent position of the Earth is diametrically opposite the geocentric position of the planet, and the Sun is opposite the heliocentric position. The planetocentric angular distance of the Earth from the equator of the planet, denoted by D_E and known as the planetocentric declination of the Earth, is numerically equal and opposite in sign to the geocentric angular distance of the planet from the plane of the equator of the planet. The angular distance in the plane of the planetary equator from the ascending node of the orbit of the planet on its equator eastward to the great circle through the Earth and the celestial pole of the planet, denoted by A_E , is known as the planetocentric right ascension of the Earth; it is equal to the geocentric longitude of the planet measured in the plane of its equator from the descending node of its orbit on its equator.

Similarly, the planetocentric right ascension of the Sun, A_S , is equal to the heliocentric longitude of the planet measured in the plane of its equator from the descending node of the orbit; and the planetocentric declination of the Sun, D_S , is numerically equal and opposite in sign to the heliocentric angular distance of the planet from the plane of the planetary equator. The planetocentric longitude of the Sun, denoted by L_S and measured in the plane of the orbit of the planet from the ascending node on its equator, is equal to the heliocentric orbital longitude of the planet reckoned from the descending node; it is tabulated only for Mars.

Planetographic longitudes on the surfaces of Mars and Jupiter are reckoned from 0° to 360° in the direction opposite the rotation, that is, eastward on the celestial sphere. The zero meridian from which the longitudes are measured is defined by the adopted position of the pole and an adopted value for the longitude of the meridian that passes through the central point of the disk at a selected epoch. The adopted longitude of the central meridian at the epoch and the rate of rotation of the planet determine the central meridian at any other time. The rotation is referred to the ascending node of the orbit on the equator of the planet, and the period is therefore known as the sidereal period of rotation; it differs slightly from the actual period of rotation, because of the precession of the axis of the planet.

For Mars, the position of the north pole that is used in computing the physical ephemeris was adopted in 1909, and the zero meridian is defined by

the tabular central meridian at Greenwich mean noon on 1909 January 15; but beginning with 1960, a period of rotation is adopted that differs from the value used before 1960. Consequently, from 1959 to 1960 there is a discontinuity in the tabular longitude of the central meridian, amounting to about -1° . The adopted rotation elements of Mars are:

North pole (LOWELL and CROMMELIN, *Mon. Not. Roy. Astr. Soc.*, **66**, 56, 1905)

At the beginning of the year t ,

$$\alpha_0 = 21^h 11^m 10^s.42 + 1^s.565 (t - 1950.0),$$

$$\delta_0 = +54^\circ 39' 27'' + 12''.60 (t - 1950.0).$$

Sidereal period of rotation (ASHBROOK, *Astr. Jour.*, **58**, 145, 1953)

In Ephemeris Time, $24^h 37^m 22^s.6689$.

Central meridian, referred to the zero meridian of 1909

Longitude of central meridian,

$$1909 \text{ Jan. 15, G.M.N. (J.D. 241 8322.0), } 344^\circ.41.$$

Daily motion, $350^\circ.891 \ 962$.

The tabular central meridian is for the geometric disk, not the illuminated disk; and the time of transit of the zero meridian is for the transit across the central point of the geometric disk.

The position angle of the axis is the angle which the meridian from the central point of the disk to the north pole of rotation forms with the declination circle through the central point, measured eastward from the north point of the disk.

For Jupiter, the adopted position of the pole is derived from the position for 1750 given by DAMOISEAU, *Tables Écliptiques des Satellites de Jupiter* (Paris, 1836), page i; the longitude of the central meridian that defines the zero meridian, and the rate of rotation, are adopted from the ephemeris last published by MARTH, *Mon. Not. Roy. Astr. Soc.*, **56**, 523, 1896:

North Pole of Jupiter

At the beginning of the year t ,

$$\alpha_0 = 17^h 52^m 00^s.84 + 0^s.247 (t - 1910.0),$$

$$\delta_0 = +64^\circ 33' 34''.6 - 0''.60 (t - 1910.0).$$

	System I	System II
<i>Sidereal period of rotation</i>	$9^h 50^m 30^s.903$	$9^h 55^m 40^s.632$
<i>Central meridian</i>		
Longitude,		
1897 July 14, G. M. N. (J.D. 241 4120.0)	$47^\circ.31$	$96^\circ.58$
Daily motion	$877^\circ.90$	$870^\circ.27$

System I applies to all points on or between the north component of the south equatorial belt and the south component of the north equatorial belt; System II applies north of the south component of the north equatorial belt, with some rare exceptions, and south of the north component of the south equatorial belt.

The tabular central meridians are for the geometric disk; applying to them the corrections in the column headed *Correction for Phase* gives the longitudes

of the central meridian of the apparent or illuminated disk. In addition, the longitude of the central meridian of the illuminated disk is tabulated at daily intervals in a separate ephemeris; the tables of the motion of the central meridian accompanying this ephemeris are based on the mean daily synodic rotations during the period when Jupiter is observable, which are $877^{\circ}95$ for System I, and $870^{\circ}30$ for System II. An accuracy of 0.1 for the central meridian of the illuminated disk is usually sufficient, and may readily be obtained from the daily ephemeris; interpolation in the 4-day ephemeris is less convenient, but may be made in the infrequent cases when an accuracy of 0.01 is needed.

The ephemeris for physical observations of Jupiter includes the period near conjunction, for the purpose of radio observations.

Satellites

The ephemerides of the satellites are intended only for search and identification, not for the exact comparison of theory with observation; they are calculated only to an order of accuracy sufficient for the purpose of facilitating observations. They are corrected for light-time; the tabular values are directly comparable with observations at the tabular times. The value of the light-time used in calculating the ephemerides of the satellites is 498^s58 for unit distance. The orbital elements and constants are given in the *Explanatory Supplement*.

The apparent orbit of a satellite is an ellipse on the celestial sphere, with semimajor axis a/Δ , where a is the apparent semimajor axis at unit distance in seconds of arc and Δ is the geocentric distance of the primary. The value of the eccentricity of the apparent orbit at opposition is used in calculating the tables for finding the position angle p of the satellite relative to the primary, measured from north toward east, and the apparent distance s from the central point of the disk of the primary. The effect of the eccentricity of the actual orbit upon its projection into the apparent orbit, and the variation of the eccentricity of the apparent orbit, are neglected. Approximately, therefore, $s = F(a/\Delta)$, where F is the ratio of s to the apparent distance at greatest elongation; and at the greatest elongations $p = P \pm 90^{\circ}$, where P is the position angle of the extremity of the minor axis of the apparent orbit that is directed toward the pole of the orbit from which the motion appears counterclockwise. With P_0 denoting an arbitrary fixed integral number of degrees near the value of P at opposition, the value of p at any time is expressed in the form $p_1 + p_2$, where p_1 is the sum of the approximate position angle $P_0 + 90^{\circ}$ at elongation and the amount of motion in position angle since elongation, and p_2 denotes the correction $P - P_0$. In the tables of p_1 the tabular entry for argument $0^h 00^m$ is the value of $P_0 + 90^{\circ}$.

The differences of right ascension and declination, in the sense "satellite minus primary", are approximately

$$\Delta\alpha = s \sin p \sec(\delta + \Delta\delta), \quad \Delta\delta = s \cos p,$$

in which $s \sin p$ and $s \cos p$ are the rectangular coordinates of the satellite in the directions perpendicular to the circle of declination and along this circle, respectively.

Satellites of Mars (Pages 332–335)

The ephemerides of the satellites of Mars are computed from the orbital elements given by H. STRUVE, *Sitzungsberichte der Königl. Preuss. Akademie der Wissenschaften*, 1911, page 1073.

Satellites of Jupiter (Pages 336–363)

The ephemerides of Satellites I–IV are based on SAMPSON'S *Tables of the Four Great Satellites of Jupiter*, London, 1910; but they are computed in accordance with the procedures developed by H. ANDOYER, *Bulletin Astronomique*, **32**, 177, 1915, in which a number of approximations and modifications of the tabular procedures are made.

The elongations of Satellite V are computed from circular orbital elements determined by A. J. J. VAN WOERKOM, *Astr. Pap. Amer. Eph.*, vol. XIII, Part I, 1950, pages 8, 14, 16.

The differential coordinates of Satellites VI and VII are computed from J. BOBONE'S tables, *Astronomische Nachrichten*, 6279, 321, 1937, and 6309, 401, 1937.

The actual phenomena of Satellites I–IV are not instantaneous. Since the predicted times are for mid-phenomena, a satellite is usually observable after the given time of EcD and before the time of EcR. In the case of Satellite IV the difference is sometimes quite large. The light curves of the eclipse phenomena are discussed in *Planets and Satellites* (The Solar System, vol. III) ed. Gerard P. Kuiper and Barbara M. Middlehurst, 1961, pages 327–340.

The approximate configurations of Satellites I–IV are shown in graphical form, to facilitate identification, on pages facing the tabular ephemerides of the eclipses and other phenomena of the satellites. The central vertical band in each diagram represents the equatorial diameter of the disk of Jupiter; time is shown by the vertical scale, each horizontal line denoting 0^h U.T., and the relative positions of the satellites at any time with respect to the disk of Jupiter are given by the curves. In constructing these diagrams, the coordinates of the satellites in the direction perpendicular to the equator of Jupiter are necessarily neglected.

For eclipses, the points *d* of immersion into the shadow and points *r* of emersion from the shadow are shown pictorially at the foot of the right-hand page for the superior conjunctions nearest the middle of each month; and at the foot of the left-hand page the rectangular coordinates of these points are given, in units of the equatorial radius of Jupiter. The axis of *x* is parallel to the equator of Jupiter, positive toward the east, and the axis of *y* is positive toward the north pole of Jupiter. The suffix 1 refers to the beginning of an eclipse, the suffix 2 to the end of an eclipse.

Satellites and Rings of Saturn (Pages 364–379)

The ephemeris of the rings of Saturn is computed from the elements of the plane of the rings determined by G. STRUVE, *Veröff. d. Universitätssternwarte zu Berlin-Babelsberg*, VI, 4, page 49, 1930. The apparent outer dimensions of the outer ring are according to H. STRUVE, *Pub. de l'Obs. Central Nicolas*, XI, page

226, 1898; the factors for computing the relative dimensions of the rings are from BESSEL, *Abhandlungen*, I, pages 110, 150, 319, except those for the dusky ring which are based on the observations of various astronomers.

The ephemeris of the rings gives the quantities that determine the Saturnicentric positions of the Earth and the Sun referred to the plane of the rings, upon which the appearance of the rings depends; the tabular quantities are:

U , the geocentric longitude of Saturn, measured in the plane of the rings eastward from its ascending node on the mean equator of the Earth; the Saturnicentric longitude of the Earth, measured in the same way, is $U+180^\circ$.

B , the Saturnicentric latitude of the Earth referred to the plane of the rings, positive toward the north; when B is positive, the visible surface of the rings is the northern surface.

P , the geocentric position angle of the northern semiminor axis of the apparent ellipse of the rings, measured from north toward east.

U' , the heliocentric longitude of Saturn, measured in the plane of the rings eastward from its ascending node on the ecliptic; the Saturnicentric longitude of the Sun, measured in the same way, is $U'+180^\circ$.

B' , the Saturnicentric latitude of the Sun referred to the plane of the rings, positive toward the north; when B' is positive, the northern surface of the rings is the illuminated surface.

P' , the heliocentric position angle of the northern semiminor axis of the rings on the heliocentric celestial sphere, measured eastward from the circle of latitude through Saturn.

The ephemeris of the rings is corrected for light-time.

The ephemerides of the six inner satellites and of Iapetus are computed from the orbital elements determined by G. STRUVE, *Veröff. d. Universitätssternwarte zu Berlin-Babelsberg*, VI, Parts 4 (1930) and 5 (1933). The ephemeris of Hyperion is computed from the elements given by J. WOLTJER, Jr., *Annalen van de Sterrewacht te Leiden*, XVI, Part 3, page 64, 1928; and of Phoebe, from the theory by F. E. ROSS, *Annals of Harvard College Observatory*, LIII, Number VI, 1905.

For the eight inner satellites, the times of conjunctions and elongations, and tables for finding the approximate apparent distance s and position angle p , are given. On the diagram of the orbits of Satellites I–VII, the points of eastern elongation are marked as “0”; and from the tabular times of these elongations, the apparent position of a satellite at any other time may be marked on the diagram by setting off on the orbit the elapsed interval since last eastern elongation. For Hyperion and Iapetus, ephemerides of the differential coordinates are also included; and an ephemeris of differential coordinates is given for Phoebe.

In calculating the elongations and conjunctions, and the tables of apparent distance and position angle, solar perturbations are not included for any of the

eight satellites; and for the five innermost satellites, the orbital eccentricity e is neglected. However, the mean longitude L and mean anomaly M , calculated from accurate values of the orbital elements, and including for Titan the solar perturbations, are tabulated at 10-day intervals for the eight inner satellites, and with them are given the values of the elements that have large variations. From the orbital position of the satellite determined with these tabular values, and the Saturnicentric position of the Earth referred to the orbital plane of the satellite, values for the apparent distance and position angle may be calculated, and differential coordinates in right ascension and declination determined.

The mean orbital longitude L and the true longitude u of the eight inner satellites, and the longitude θ of the ascending node of the orbit on the plane of the rings, are measured from the ascending node of the ring-plane on the mean equator of the Earth; L and u are reckoned along the ring-plane to the node of the orbit, then along the orbit. Prior to 1966, L and u for Hyperion and Iapetus were reckoned from the node of the orbit on the equator of the Earth, and ephemerides were given for U , B , and P referred to the orbital plane. The tabular values of L and M are the geometric values at the tabular times, not corrected for light-time.

The formulae and constants for obtaining the true orbital longitude u and the radius vector r of the eight inner satellites are:

Mimas

$$\begin{aligned} u &= L + 2^{\circ}303 \sin M + 0^{\circ}029 \sin 2M, \\ \frac{r}{a} &= 1.0002 - 0.0201 \cos M - 0.0002 \cos 2M, \\ a &= 255''9, \quad \sin \gamma = 0.0265. \end{aligned}$$

Enceladus

$$\begin{aligned} u &= L + 0^{\circ}509 \sin M, \\ \frac{r}{a} &= 1 - 0.0044 \cos M, \\ u - \theta &= 36^{\circ} + 263^{\circ}15 \text{ (J.D.} - 243\,6000.5), \\ a &= 328''3, \quad \sin \gamma = 0.0004. \end{aligned}$$

Tethys

$$\begin{aligned} u &= L, \quad \frac{r}{a} = 1, \\ a &= 406''4, \quad \sin \gamma = 0.0191. \end{aligned}$$

Dione

$$\begin{aligned} u &= L + 0^{\circ}253 \sin M, \\ \frac{r}{a} &= 1 - 0.0022 \cos M, \\ u - \theta &= 214^{\circ} + 131^{\circ}62 \text{ (J.D.} - 243\,6000.5), \\ a &= 520''5, \quad \sin \gamma = 0.0004. \end{aligned}$$

Rhea

$a = 726''.9,$	
$e = 0.00086$	June 9—June 12,
$= 0.00085$	June 13—September 2,
$= 0.00084$	September 3—November 24,
$= 0.00083$	November 25—December 36.

Titan

$a = 1684''.4,$	
$e = 0.02885$	June 9—September 21,
$= 0.02884$	September 22—December 36.

Rhea, Titan, Hyperion

$$u = L + 2e \sin M + \dots,$$

$$\frac{r}{a} = 1 + \frac{1}{2}e^2 - e \cos M - \frac{1}{2}e^2 \cos 2M - \dots$$

Iapetus

$a = 4908''.6,$	
$\theta = 255^\circ 45'$	June 9—August 7,
$= 255.44$	August 8—November 6,
$= 255.43$	November 7—December 36.
$u = L + 3^\circ 240' \sin M + 0^\circ 057' \sin 2M + 0^\circ 001' \sin 3M,$	
$\frac{r}{a} = 1.0004 - 0.0283 \cos M - 0.0004 \cos 2M.$	

The apparent rectangular coordinates referred to Saturnicentric axes, with the x -axis in the plane of the rings and positive toward the east, the y -axis positive toward the north pole of Saturn, are

$$x = \frac{a}{\Delta} \frac{r}{a} \frac{1}{1 + \zeta} \sin (u - U)$$

$$= s \sin (p - P),$$

$$y = \frac{a}{\Delta} \frac{r}{a} \frac{1}{1 + \zeta} \left[\sin B \cos (u - U) + \cos B \sin \gamma \sin (u - \theta) \right]$$

$$= s \cos (p - P),$$

in which U and B refer to the plane of the rings, and u is measured from the node of the rings on the equator of the Earth to the node of the orbit on the rings, then along the orbit.

Mimas

$u-U$	$\frac{1}{1+\zeta}$	$u-U$
0.0		0.0
67.3	0.9999	292.7
112.6	1.0000	247.4
247.3	1.0001	112.7

Enceladus

$u-U$	$\frac{1}{1+\zeta}$	$u-U$
0.0		0.0
25.9	0.9998	334.1
72.5	0.9999	287.5
107.4	1.0000	252.6
154.0	1.0001	206.0
205.9	1.0002	154.1

Tethys

$u-U$	$\frac{1}{1+\zeta}$	$u-U$
0.0		0.0
43.4	0.9998	316.6
75.9	0.9999	284.1
104.0	1.0000	256.0
136.5	1.0001	223.5
223.4	1.0002	136.6

Dione

$u-U$	$\frac{1}{1+\zeta}$	$u-U$
0.0		0.0
19.0	0.9997	360.0
55.4	0.9998	341.0
79.1	0.9999	304.6
100.8	1.0000	280.9
124.5	1.0001	259.2
160.9	1.0002	235.5
199.0	1.0003	199.1
		161.0

Rhea

$u-U$	$\frac{1}{1+\zeta}$	$u-U$
0.0		0.0
18.6	0.9996	360.0
47.4	0.9997	341.4
66.0	0.9998	312.6
82.2	0.9999	294.0
97.7	1.0000	277.8
113.9	1.0001	262.3
132.5	1.0002	246.1
161.3	1.0003	227.5
198.6	1.0004	198.7
		161.4

Titan

$u-U$	$\frac{1}{1+\zeta}$	$u-U$
0.0		0.0
6.8	0.9991	360.0
28.8	0.9992	353.2
40.5	0.9993	331.2
50.0	0.9994	319.5
58.2	0.9995	310.0
65.8	0.9996	301.8
73.0	0.9997	294.2
79.9	0.9998	287.0
86.6	0.9999	280.1
93.3	1.0000	273.4
100.0	1.0001	266.7
106.9	1.0002	260.0
114.1	1.0003	253.1
121.7	1.0004	245.9
129.9	1.0005	238.3
139.4	1.0006	230.1
151.1	1.0007	220.6
173.1	1.0008	208.9
186.8	1.0009	186.9
		173.2

Hyperion

$u-U$	$\frac{1}{1+\zeta}$	$u-U$
0.0		0.0
23.7	0.9990	360.0
35.0	0.9991	336.3
43.7	0.9992	325.0
51.2	0.9993	316.3
58.0	0.9994	308.8
64.3	0.9995	302.0
70.3	0.9996	295.7
76.0	0.9997	289.7
81.7	0.9998	284.0
87.2	0.9999	278.3
92.7	1.0000	272.8
98.3	1.0001	267.3
103.9	1.0002	261.7
109.6	1.0003	256.1
115.6	1.0004	250.4
121.9	1.0005	244.4
128.6	1.0006	238.1
136.1	1.0007	231.4
144.8	1.0008	223.9
155.9	1.0009	215.2
180.0	1.0010	204.1
		180.0

Iapetus

$u-U$	$\frac{1}{1+\zeta}$	$u-U$
0.0		0.0
10	0.9975	0 360
20	0.9976	+1 350
30	0.9978	2 340
40	0.9981	3 330
50	0.9984	3 320
60	0.9988	4 310
70	0.9992	4 300
80	0.9996	4 290
90	1.0000	4 280
100	1.0004	4 270
110	1.0008	4 260
120	1.0012	4 250
130	1.0016	4 240
140	1.0019	3 230
150	1.0022	3 220
160	1.0024	2 210
170	1.0025	+1 200
180	1.0025	0 190
		180

In critical cases ascend

Satellites of Uranus (Pages 380–382)

The ephemerides of Ariel and Umbriel are computed from the orbital elements determined by NEWCOMB, *Washington Obs. for 1873*, App. I; of Titania and Oberon, from the elements by H. STRUVE, *Abh. d. K. Preuss. Akad. d. Wiss.*, 1912. STRUVE's elements of the plane of the orbits are adopted for all four satellites.

Satellites of Neptune (Page 383)

The ephemeris of Triton is calculated from elements by W. S. EICHELBERGER and ARTHUR NEWTON, *Astr. Pap. Amer. Eph.*, vol. IX, Part III, 1926.

Sunrise, Sunset, and Twilight (Pages 384–391)

The tabular times of sunrise and sunset are the instants when the true geocentric zenith distance of the central point of the disk is $90^{\circ} 50'$. With an adopted value of $34'$ for the horizontal refraction, and $16'$ for the semidiameter, the apparent zenith distance of the upper limb, neglecting parallax, is then 90° , and the limb is apparently on the astronomical horizon. The tabular times of the beginning and end of astronomical twilight are the instants when the true geocentric zenith distance of the central point of the disk is 108° .

The tabular values give the local mean times of the phenomena on the meridian of Greenwich for northern latitudes up to $+60^{\circ}$. No interpolation is usually made for the local times at other longitudes; the error from neglecting the variation with longitude is negligible, amounting to a maximum of 2^m in latitude 60° north. To obtain the local *standard* time or zone time, increase the local time four minutes for each degree of longitude west of the standard meridian, or decrease the local time four minutes for each degree east of the standard meridian.

In a *southern* latitude, the time of sunrise, sunset, or beginning or end of twilight, is obtained for any date by entering the table with the same *numerical value* of the latitude, but for a date about six months earlier or later than the actual date, and applying a small correction to the tabular time; these dates and corrections are tabulated at the foot of the page. The periods during which twilight lasts all night in southern latitudes may be found by substituting for the northern latitudes the corresponding southern latitudes, and for the dates the corresponding dates taken from the foot of the page.

Example

On 1967 May 5, in latitude -38° , required the times of sunrise, sunset, and beginning and end of twilight. November 7 is the corresponding date, northern latitude, and the correction is $+13^m$.

	Beginning of Twilight		Sunrise		Sunset		End of Twilight	
	h	m	h	m	h	m	h	m
Lat. $+38^{\circ}$, Nov. 7	5	01	6	31	16	56	18	25
Auxiliary table	+13		+13		+13		+13	
<hr/>								
Lat. -38° , Local mean time, May 5 . .	5	14	6	44	17	09	18	38

The tabular values are based on the “Tables of Sunrise, Sunset, and Twilight” published as a *Supplement to the American Ephemeris for 1946*. These

tables provide for obtaining the times at any point on the Earth in any year of the twentieth century.

Moonrise and Moonset (Pages 392-423)

The tabular times of moonrise and moonset are the instants when the true geocentric zenith distance of the central point of the disk is $90^\circ 34' + s - \pi$, where s is the semidiameter and π the horizontal parallax of the Moon, and $34'$ is the adopted horizontal refraction; the upper limb is then apparently on the astronomical horizon. No allowance is made for the phase of the Moon.

The tabular times are for the meridian of Greenwich, and are given both for northern and for southern latitudes from $+60^\circ$ to -60° . To obtain the local mean time of moonrise or moonset at other longitudes that are 12 hours or less west from Greenwich, take out the tabular times for the given date and for the next following date; at longitudes 12 hours or less east from Greenwich, take out the times for the given date and for the date preceding. Subtract the time on the earlier date from the time on the later date; multiply the difference by the twenty-fourth part of the longitude in hours and decimals of an hour, positive if west, negative if east; apply the product as a correction to the tabular time on the given date to obtain the required local mean time. To obtain the standard time or zone time, increase the local time by four minutes for each degree of longitude west of the standard meridian, or decrease the local time by four minutes for each degree east of the standard meridian.

Examples

1. For 1967 January 21, find the standard time of moonrise and moonset at longitude 145° or $9^h 40^m$ east from Greenwich (20^m west of the standard meridian) and latitude $27^\circ 50'$ south.

	d	Moonrise h m	Moonset h m
For Lat. $-27^\circ 8'$	Jan. 20	13 50	0 10
	Jan. 21	14 48	0 45
Difference		+58	+35
Product of diff. by $-9.7/24$		-23	-14
Local mean time.	Jan. 21	14 25	0 31
Reduction to standard time		+20	+20
Standard time.	Jan. 21	14 45	0 51

2. For 1967 July 10, find the Eastern Standard Time of moonrise and moonset at Washington, D.C., longitude 77° or $5^h 08^m$ west, latitude $38^\circ 55'$ north.

	d	Moonrise h m	Moonset h m
For Lat. $+38^\circ 9'$	July 10	7 22	21 51
	July 11	8 35	22 20
Difference		+73	+29
Product of diff. by $+5.1/24$		+15	+ 6
Local mean time.	July 10	7 37	21 57
Reduction to standard time		+ 8	+ 8
Eastern Standard Time	July 10	7 45	22 05

Astronomical Observatories (Pages 424-444)

The list of optical observatories is followed by a list of radio observatories; and an *Index List* is given for finding observatories that are better known by special names than by their geographic location.

The latitudes in most cases are astronomical; but in some instances they have been determined by geodetic triangulation from other points. The geocentric coordinates $\rho \sin \phi'$ and $\rho \cos \phi'$ are calculated for the International Ellipsoid; the altitude is included in every case where it is known.

The last two columns on the right-hand pages contain the parallax constants

$$\begin{aligned}\Delta_{xy} &= -\rho \cos \phi' \sin 8''.80 \\ &= -426.64 \rho \cos \phi' \times 10^{-7}, \\ \Delta Z &= -\rho \sin \phi' \sin 8''.80 \\ &= -426.64 \rho \sin \phi' \times 10^{-7};\end{aligned}$$

the tabular values are in units of the seventh decimal. Formulae for parallax corrections in right ascension and declination, and for corrections to the equatorial rectangular coordinates of the Sun to eliminate parallax, are given at the foot of each right-hand page.

Tables (Pages 445-473)

A list of the individual tables is given in the *Contents*.

Table I of Julian Day Numbers is explained in the section on the calendar.

Table II, for determining latitude and azimuth from observations of Polaris, includes the precepts for the use of the table at the foot of each page.

Table III, for the reduction of mean places from one epoch to another, is explained in the section on mean places of stars. Tables IV-VI relating to reductions for precession, nutation, and differential aberration, include precepts for their use, and are referred to in the section on Day Numbers.

The precepts for using Table VII to calculate geocentric coordinates are given below the table.

Tables VIII-XII for conversions of measures of time, and the Interpolation Tables XIII-XVII are self-explanatory.

INDEX

Aberration, differential, Table V	454	Eclipses	4, 293
planetary, correction for	491	Besselian elements, definitions	496
Apparent position, definition	481	calculation of local predictions	496
Arc, conversion to time, Table XII	467	Ecliptic, mean obliquity	50, 487
Ariel	380, 510	obliquity	18
apparent distance and position		rotation and position	50, 487
angle	380	short-period nutation in obliq-	
elongations	382	uity	258
Astrometric position, definition	491	Enceladus	366
Astronomical day, definition	477	apparent distance and position	
Astronomical unit, definition	484	angle	370
Azimuth from Polaris, Table II	448	elongations	368
		orbital position	374, 507
Besselian year, beginning of	2	Ephemeris day, definition	484
definition	478	Ephemeris longitude, definition	482
fraction of	258	Ephemeris meridian, definition	482
Calendar	2	Ephemeris second, definition	484
Calendars, ecclesiastical	1	Ephemeris sidereal time, definition	482
Callisto	336	Ephemeris Time, definition	474, 484
phenomena and configurations	340	determination	474
superior geocentric conjunctions	339	reduction to, from Universal	
Ceres, geocentric ephemeris	236, 492	Time	vii
geocentric phenomena	8	Ephemeris transit, definition	482
magnitude, photographic	236	Equation of the equinoxes	10
magnitude, visual	9	definition	475
Constants, astronomical	484	Equinoxes, dates	4, 479
Cycles, chronological	1	Eras, chronological	1
		Europa	336
Day, conversion of hours, minutes,		phenomena and configurations	340
and seconds to decimals of,		superior geocentric conjunctions	339
Table X	464	Fictitious mean sun, definition	476
Day Numbers	492	First Point of Aries, transit	10
Besselian, for 0 ^h E.T.	258	Ganymede	336
Besselian, for 0 ^h sidereal time	274	phenomena and configurations	340
Independent	259	superior geocentric conjunctions	339
second-order	278	Gaussian constant	484
Deimos	332	Geocentric coordinates, Table VII	457
apparent distance and position		Gravity, normal	485
angle	333	Greenwich sidereal date	10, 480
elongations	332	Greenwich Sidereal Day Number,	
Dione	366	definition	480
apparent distance and position		Hyperion	366
angle	370	apparent distance and position	
elongations	368	angle	372
orbital position	374, 507	conjunctions and elongations	369
Earth, aphelion and perihelion	4	differential coordinates	377
International reference ellipsoid	485	orbital position	376

Iapetus	366	Mercury, elongation	8
apparent distance and position		geocentric ephemeris	178
angle	372	heliocentric ephemeris	160
conjunctions and elongations . .	369	illuminated disk	314, 501
differential coordinates	378	magnitude	8, 314
orbital position	376	mean elements, mean anomaly .	176
Interpolation formulae and tables . .	468	Meridian transit, calculation from	
Io	336	ephemeris transit	483
phenomena and configurations .	340	Mimas	366
superior geocentric conjunctions.	338	apparent distance and position	
Julian Date	2, 10	angle	370
Julian Day Number, Table I	445	elongations	367
definition	477	orbital position	374, 507
Julian Ephemeris Date, definition . .	478	Miranda	380
Juno, geocentric ephemeris	245, 492	Months, lengths	489
geocentric phenomena	8	Moon, age	306, 499
magnitude, photographic	245	apogee and perigee	5, 159
magnitude, visual	9	conjunctions with planets. . . .	5
Jupiter, diameter, equatorial and		ephemeris transit	52
polar	324	librations	306, 499, 500
elongation	9	longitude and latitude	52
geocentric ephemeris.	202	mean elongation	51, 489
heliocentric ephemeris	174	mean equator	51, 490
magnitude	9, 324	mean longitude	51, 489
osculating elements	177	mean orbit	51, 489
physical ephemeris	324, 501	parallax	52
rotation elements	503	phases	5, 159, 490
satellites	336, 505	physical ephemeris	306, 499
semidiameter, polar	202	right ascension and declination .	68
Latitude from observed altitude of		semidiameter	52, 490, 495
Polaris, Table II	448	Moonrise and moonset.	511
Mars, diameter	316	northern latitudes.	392
elongation	9	southern latitudes.	408
geocentric ephemeris	194	Neptune, elongation	9
heliocentric ephemeris	172	geocentric ephemeris	226
magnitude	9, 316	heliocentric ephemeris	175
mean elements, mean anomaly .	176	magnitude	9
physical ephemeris	316, 501	osculating elements	177
rotation elements	503	satellites.	383, 510
satellites	332, 505	Nereid	383
semidiameter	194	Nutation	486
Mean solar day, definition	476	differential, Table VI	456
Mean solar second, definition	484	in longitude	18
Mean solar time, conversion to mean		short-period, in longitude and	
sidereal time, Table IX	461, 477	obliquity	258
definition	475	short-period terms, definition . .	486
determination from sidereal		Oberon	380, 510
time	476, 480	apparent distance and position	
Mean sun, fictitious, definition . . .	476	angle	380
		elongations	382
		Observatories	424, 512
		index list	442
		radio	438

Occultations	5	Sidereal time, calculation from mean solar time	481
Osculation dates	453, 494	conversion to mean solar time, Table VIII	458, 477
Pallas, geocentric ephemeris . . .	241, 492	definition	475
geocentric phenomena	8	determination by observation . .	475
magnitude, photographic	241	of 0 ^h Universal Time	10, 476
magnitude, visual	9	Solstices, dates	4, 479
Parallax, constants and corrections .	425, 512	Star constants, Besselian	493
Phenomena	4, 478	Stars, mean places	282
Phobos	332	reduction from equinox of 1950.0 to true equinox, Table IV . . .	453
apparent distance and position angle	335	reduction of mean places . . .	50, 452, 494
elongations	334	reduction of mean to apparent place	492
Phoebe	366	Sun, aberration	488
differential coordinates	379	ephemeris transit	19
Planets, configurations with Sun, Moon, <i>et al.</i>	4, 5, 8, 478	longitude and latitude	18
semidiameters at unit distance . .	491	mean anomaly	50
Pluto, astrometric ephemeris . . .	234	mean elements	50, 487
elongation	9	mean longitude	50
heliocentric ephemeris	176	parallax	18
magnitude	9	physical ephemeris	300, 499
osculating elements	177	radius vector	19
Pole Star table for latitude and azimuth, Table II	448	rectangular coordinates, 1950.0 .	42
Precession, annual rates	485	rectangular coordinates, 1967.0 .	34
differential, Table VI	456	reduction to apparent longi- tude	18, 488
displacements of equator and equinox	486	right ascension and declination .	19
in longitude	18	rotation elements	499
reductions, constants for epoch 1950.0	50	semidiameter	19, 488, 495
reductions, mean places of stars, Table III	452, 494	synodic rotations	305, 499
Radio observatories	438	Sunrise and sunset	384, 510
Rhea	366	Tethys	366
apparent distance and position angle	372	apparent distance and position angle	370
elongations	368	elongations	367
orbital position	375, 508	orbital position	374, 507
Saturn, diameter, equatorial and polar	330	Time, conversion to arc, Table XI .	466
elongation	9	Titan	366
geocentric ephemeris	210	apparent distance and position angle	372
heliocentric ephemeris	175	elongations and conjunctions . .	369
magnitude	9, 330	orbital position	375, 508
osculating elements	177	Titania	380, 510
physical ephemeris	330, 501	apparent distance and position angle	380
rings	364, 505	elongations	382
satellites	366, 505	Triton	383, 510
semidiameter, polar	210	apparent distance and position angle	383
Sidereal day, definition	475	elongations	383

Twilight, astronomical	384, 510	Uranus, elongation	9
Umbriel	380, 510	geocentric ephemeris	218
apparent distance and position		heliocentric ephemeris	174
angle	380	magnitude	9
elongations	382	osculating elements	177
Units, fundamental	484	satellites	380, 510
Universal Time, conversion of ephemerides to	483	Venus, elongation	8
definition	474, 476	geocentric ephemeris	186
determination	474, 476	greatest brilliancy	4, 479
of meridian transit, calculation		heliocentric ephemeris	168
of	483	illuminated disk	315, 501
of Transit of First Point of		magnitude	8, 315
Aries	10	mean elements, mean anomaly	176
reduction from, to Ephemeris		Vesta, geocentric ephemeris	251, 492
Time	vii	geocentric phenomena	8
		magnitude, photographic	251
		magnitude, visual	9
		Year, length	478, 487



